TONGUE RIVER BASIN PROJECT

June 1995

Draft Environmental Impact Statement

TONGUE RIVER BASIN PROJECT

DRAFT ENVIRONMENTAL IMPACT STATEMENT

NOTICE - JUNE 5, 1995

The United States Bureau of Reclamation (USBR), the Northern Cheyenne Tribe (Tribe), and the Montana Department of Natural Resources and Conservation (DNRC) have recently completed a draft environmental impact statement (draft EIS) on the proposed Tongue River Basin Project. These project sponsors propose to repair and enlarge the unsafe Tongue River Dam and Reservoir, provide a portion of the water allocated to the Tribe by the Northern Cheyenne Indian Reserved Water Rights Settlement Act of 1992, and preserve and enhance fish and wildlife habitats in the Tongue River basin.

When environmental compliance activities and the preparation of this draft EIS began in 1992, the project sponsors had not identified a preferred alternative to meet the goals of the project. Subsequent to the analysis performed during the preparation of this draft EIS, the project sponsors have identified the second alternative studied [Alternative 2-Roller Compacted Concrete (RCC)] as the preferred alternative. Alternative 2 would replace the existing principal spillway at the Tongue River Dam with a new structural concrete spillway having a crest height 4 feet higher than the existing spillway crest. The RCC alternative also would include roller compacted concrete secondary and/or emergency spillway(s) over the dam embankment, repair or replacement of the existing low level outlet works, and construction of a new auxiliary outlet works. The alternative also would include project features to enhance fish and wildlife habitats in the Tongue River basin from the Montana-Wyoming border to the confluence of the Tongue and Yellowstone rivers at Miles City, Montana.

Copies of this draft EIS are being circulated for public review and comment for 60 days. The comment period ends August 4, 1995. Copies of the draft EIS are available upon request from DNRC. Requests can be made by calling (406) 444-6646, or by writing DNRC at the address below:

Edward M. Pettit, Environmental Coordinator
Montana Department of Natural Resources and Conservation
P. O. Box 202301
Helena, MT 59620-2301

Eight public hearings to receive comments on the draft EIS will be held in the project area in July 1995. The formal portion of the public hearings will be preceded by informal information sessions to answer questions about the project and the environmental review process. Persons wishing to comment on the draft EIS may do so by writing to DNRC at the above address or by presenting hand-written comments or oral testimony at one of the following hearings:

PUBLIC HEARINGS TIMES AND LOCATIONS

DATE	TIME	LOCATION	FACILITY
July 17, 1995	12:30 p.m.	Busby	Busby School Auditorium
July 17, 1995	5:30 p.m.	Lame Deer	Dull Knife Memorial College Aud.
July 18, 1995	12:30 p.m.	Muddy District	Muddy Community Center
July 18, 1995	5:30 p.m.	Ashland	St. Labre Mission Auditorium
July 19, 1995	12:30 p.m.	Birney Village	Catholic Church
July 19, 1995	5:30 p.m.	Sheridan	Holiday Inn Conference Room
July 20, 1995	5:30 p.m.	Miles City	Miles City Community College
July 21, 1995	5:30 p.m.	Billings	Fireside Inn Conference Room

The Tongue River Basin Draft Environmental Impact Statement was prepared pursuant to the National Environmental Policy Act (NEPA) and USBR's NEPA Handbook. USBR has lead federal agency responsibility for compliance with NEPA. The draft EIS also was prepared pursuant to the Montana Environmental Policy Act (MEPA). DNRC has lead responsibility for compliance with MEPA. Copies of the draft EIS and this notice were filed with the Governor, the Environmental Quality Council, and the Environmental Protection Agency on June 5, 1995.

DRAFT

TONGUE RIVER BASIN PROJECT
ENVIRONMENTAL IMPACT STATEMENT

SOUTHEASTERN MONTANA

U.S. Department of Interior
Bureau of Reclamation
Great Plains Regional Office

Neil Stessman, Director

Northern Cheyenne Tribe
Lame Deer, Montana

Llevando Fisher, President

Montana Department of Natural
Resources and Conservation
Helena, Montana

Mark Simonich, Director

June 1995

INTRODUCTION

This summary presents a condensed version of information contained in the Tongue River Basin Project draft environmental impact statement (draft EIS). Persons or agencies interested in more detailed information about this project may review the draft EIS. Copies of the draft EIS can be obtained from:

Mr. Edward Pettit, Environmental Coordinator
Montana Department of Natural Resources and Conservation
1520 East 6th Avenue
P.O. Box 202301
Helena, MT 59620-2301
(406)444-6648

A copy of the draft EIS also can be reviewed at the following locations:

- Montana Department of Natural Resources and Conservation, Helena, MT
- Montana Department of Natural Resources and Conservation, Regional Office, Billings, MT
- Northern Cheyenne Tribal Headquarters, Lame Deer, MT
- United States Bureau of Reclamation, Montana Area Office, Billings, MT
- John Wooden Legs Memorial Library, Lame Deer, MT
- Miles City Public Library, Miles City, MT
- Parmly Billings Library, Billings, MT
- Fulmer Public Library, Sheridan, WY

The Tongue River Basin Project draft EIS identifies and analyzes probable impacts to the human environment that would result from the proposed Tongue River Basin Project. The project includes the repair and enlargement of Tongue River Dam, the partial fulfillment of the Northern Cheyenne Indian Reserved Water Rights Settlement Act of 1992 (Settlement Act), and the conservation, development, and enhancement of fish and wildlife resources and habitat in the Tongue River Basin. The draft EIS was prepared jointly by the Montana Department of Natural Resources and Conservation (DNRC), the Northern Cheyenne Tribe (Tribe), and the United States Bureau of Reclamation (USBR) to comply with the National Environmental Policy Act (NEPA) and the Montana Environmental Policy Act (MEPA), and is being released to other agencies and the public for review and comment. Following the review period, a final EIS will be prepared and circulated in response to comments received on the draft EIS. After circulation of the final EIS, a Record of Decision (ROD) will be issued stating the project sponsors' (DNRC, the Tribe, and USBR) final course of action.

THE EIS PROCESS

The purpose of an EIS is to provide the information, background, and facts necessary for individuals/agencies to make informed decisions regarding a proposed project (in this case the Tongue River Basin Project). Procedures governing the EIS analysis process are defined in administrative rules for implementing NEPA and MEPA. These laws require an EIS to be prepared if a proposed action has the potential to significantly affect the quality of the human environment. Because the Tongue River Basin Project involves federal and state agencies, this draft EIS was written to fulfill the requirements of both NEPA and MEPA and the associated administrative rules and regulations for their implementation.

PURPOSE AND NEED

The Tongue River Basin Project is being proposed to alleviate dam safety concerns and protect downstream lives and property, to protect all existing water rights held in the Tongue River Reservoir, and to provide up to an additional 20,000 acre-feet of water to the Tribe. An additional requirement of the project would involve the enhancement of fish and wildlife habitat in the Tongue River Basin. All project goals are components of the Settlement Act, which ratified the Northern Cheyenne - Montana Water Rights Compact (Compact) entered into on June 11, 1991 by the Northern Cheyenne Tribe and the state of Montana.

USBR assumed lead federal responsibility under NEPA for environmental compliance activities related to the project, and DNRC assumed similar state responsibilities under MEPA. Although both USBR and DNRC consider fulfillment of the Settlement Act and elimination of dam safety concerns the major goals of the project, each agency has different legal obligations to satisfy.

The federal purpose of the Tongue River Basin Project is to protect the following Indian Trust Assets: 1) the Northern Cheyenne Tribe's existing water supplies held in the Tongue River Reservoir, 2) the safety of downstream Tribal lives and land, and 3) additional Tongue River Basin water for use by the Tribe. An additional purpose of the project is the enhancement of fish and wildlife habitat in the Tongue River Basin.

From the federal perspective, the need for the Tongue River Basin Project is as follows: the Tribe currently does not have sufficient water to satisfy the Tribal water right recognized in the Compact; Tribal life and lands are endangered by the unsafe Tongue River Dam located upstream of the reservation; and fish and wildlife resources and habitat in the Tongue River Basin have suffered as a result of human development in the area.

Indian Trust Assets are legal interests in property held in trust by the United States for Indian tribes or individuals. The federal government has a trust responsibility to protect and maintain rights reserved by or granted to Indian tribes or Indian individuals by treaties, executive orders, and other agreements entered into by Department of the Interior.

USBR identified the protection of trust assets of the Tribe as the federal action requiring NEPA compliance for the Tongue River Basin Project. The state of Montana has an interest in the Settlement Act because it fulfills the water rights compact between the Tribe and the state, and because it provides for the repair of the state-owned Tongue River Dam. DNRC is the state agency responsible for the dam.

The purpose for the state of Montana's action to be addressed under MEPA is: 1) to maintain the ability to deliver all existing water use contracts held in the Tongue River Reservoir; 2) to provide a safe dam to protect lives and property downstream; and 3) to provide increased reservoir storage that, in combination with exchange water and existing unallocated reservoir storage, would allow for the delivery of up to an additional 20,000 acre-feet of water to the Tribe. The state believes the action is necessary because: 1) the Tongue River Dam is unsafe, and 2) the Compact requires Montana to deliver up to 20,000 acre-feet of storage and exchange water to the Tribe over and above the Tribe's existing water purchase contract for 7,500 acre-feet. The state also considers fish and wildlife habitat enhancement a crucial project goal.

DEVELOPMENT OF ALTERNATIVES

Under NEPA and MEPA, the project sponsors (USBR, the Tribe, and DNRC) are required to consider the environmental effects of a proposed action, as well as reasonable alternatives to that action. Two alternatives that must be considered in an EIS are the proposed action -- in this case rehabilitating Tongue River Dam, fulfilling the Settlement Act water right, and enhancing fish and wildlife habitat -- and the no-action alternative. The no-action alternative simply would maintain existing conditions in the basin.

Public participation has been an integral component of the preparation of this draft EIS. Public meetings regarding the Compact have been held since 1980 throughout the Tongue River Basin, and several meetings were held in the early 1990s to provide information on the progress of Compact negotiations and to ask the public for questions or comments.

Three open house meetings were held in October 1991, to inform the public about studies for rehabilitating the dam. These meetings were held in Miles City and Ashland , Montana, and Sheridan, Wyoming. In March 1993, the project sponsors conducted nine scoping meetings in the project area to determine issues and concerns related to the Tongue River Basin Project and to identify possible alternatives and mitigations to be included in this draft EIS. In addition to public scoping, a meeting was held on March 23, 1993 to discuss agency scoping issues.

From this process, the project sponsors identified several significant issues that would be used to drive alternative formulation (including proposed mitigations). Issues emerged in several resource areas, including aquatics/fisheries, hydrology, socioeconomics, and recreation. A synopsis of the issues is presented below:

- Effects on aquatic resources within the reservoir and river upstream and downstream of the reservoir;
- Effects on the water rights settlement with the Northern Cheyenne Tribe;
- Impacts of flood events;
- Effects on Decker Coal mines adjacent to the reservoir;
- Effects of dam failure on human safety and property downstream of the project;
- Indian trust assets/Federal trust asset responsibility;

- Impacts to state and federal governments from the cost of construction; and

- Short-term effects on recreation resources.

The alternatives development process identified three alternatives, including no action, for consideration in this draft EIS. The two action alternatives are: 1) Labyrinth Weir Spillway, and 2) Roller-Compacted Concrete (RCC) Spillway. Both action alternatives would rehabilitate or replace the inadequate Tongue River Dam spillway and raise its crest elevation 4 feet. The resultant increase in Tongue River Reservoir capacity would provide additional water to the Tribe and thus partially fulfill the provisions of the Settlement Act. A fundamental component of both action alternatives provides for the enhancement of fish and wildlife habitat in the Tongue River Basin.

Construction of either action alternative would last about 2 years. Construction employment would include a Tribal hiring preference requiring that up to 75 percent of the project-related work force be comprised of Tribal workers. **Table S-1** provides a detailed comparison of major project components by action alternative.

At the initiation of draft EIS preparation, the project sponsors had not identified a preferred alternative. After completion of the environmental analysis contained in this document, the project sponsors identified Alternative 2, RCC Spillway, with an auxiliary outlet works as the preferred alternative.

In addition to the alternatives analyzed in the draft EIS, several additional alternatives were considered but dismissed during the early stages of EIS preparation. These alternatives were technically or economically infeasible, resulted in greater environmental effects, were beyond the ability of the project sponsors to implement, or offered no advantages to alternatives analyzed in the draft EIS. The range of alternatives considered but dismissed included:

- purchasing water to satisfy the Settlement Act water right;

- constructing a new dam at another location;

- mining coal underneath the reservoir to pay for a new dam;

- finding alternative sources of water to impound or develop for satisfaction of Settlement Act water rights; and

- repairing the dam and giving a cash settlement to the Tribe in lieu of additional water.

EXISTING ENVIRONMENT

Tongue River Dam and Reservoir are located in Big Horn County in southeastern Montana, about 5 miles from the Montana/Wyoming border (see **Figure S-1**). The nearest towns are Ashland, Montana, and Sheridan, Wyoming.

TABLE S-1
Comparison of Project Components by Alternative

	ALTERNATIVE 1 (Labyrinth Weir)	ALTERNATIVE 2 (RCC)
Spillway design flood outflow, cfs	100,000	100,000
Maximum reservoir elevation, feet	3,428.4	3,428.4
Maximum reservoir storage, acre-feet	80,000	80,000
Maximum reservoir storage during construction, acre-feet[1]	35,000	45,000
Minimum reservoir storage during construction, acre-feet	9,000	9,000
Coffer dams upstream and downstream	yes	yes
Auxiliary low level outlet works	yes	no[2]
New Inundation, acres	400	400
Peak 100-year flood outflow, cfs	18,928	11,135
Average downstream floodplain width, feet	487	387
Average downstream floodplain depth, feet	13.5	10.8
Aggregate Site No. 1 disturbed acres (max)	60	20
Aggregate Site No. 2 disturbed acres (max)	0	10
Staging area disturbed acres (max)	36	36
County Road No. 380 disturbed, miles	8.5	8.5
County Road No. 380 shutdown during construction, miles	1.5	1.5
Tongue River State Park relocated	yes	yes
Tongue River Canyon fishing access site disturbed during construction	yes	yes
Coal mine mitigation required	yes	yes
Structure and shore erosion protection required	yes	yes
Peak employment, persons	26	16
Construction cost, million $	27	17[3]/18[4]

Note:
[1] Depending on inflows to the reservoir and other safety considerations
[2] Subject to Record of Decision (ROD)
[3] Construction cost for RCC spillway without an auxiliary low level outlet works
[4] Construction cost for RCC spillway with an auxiliary low level outlet works

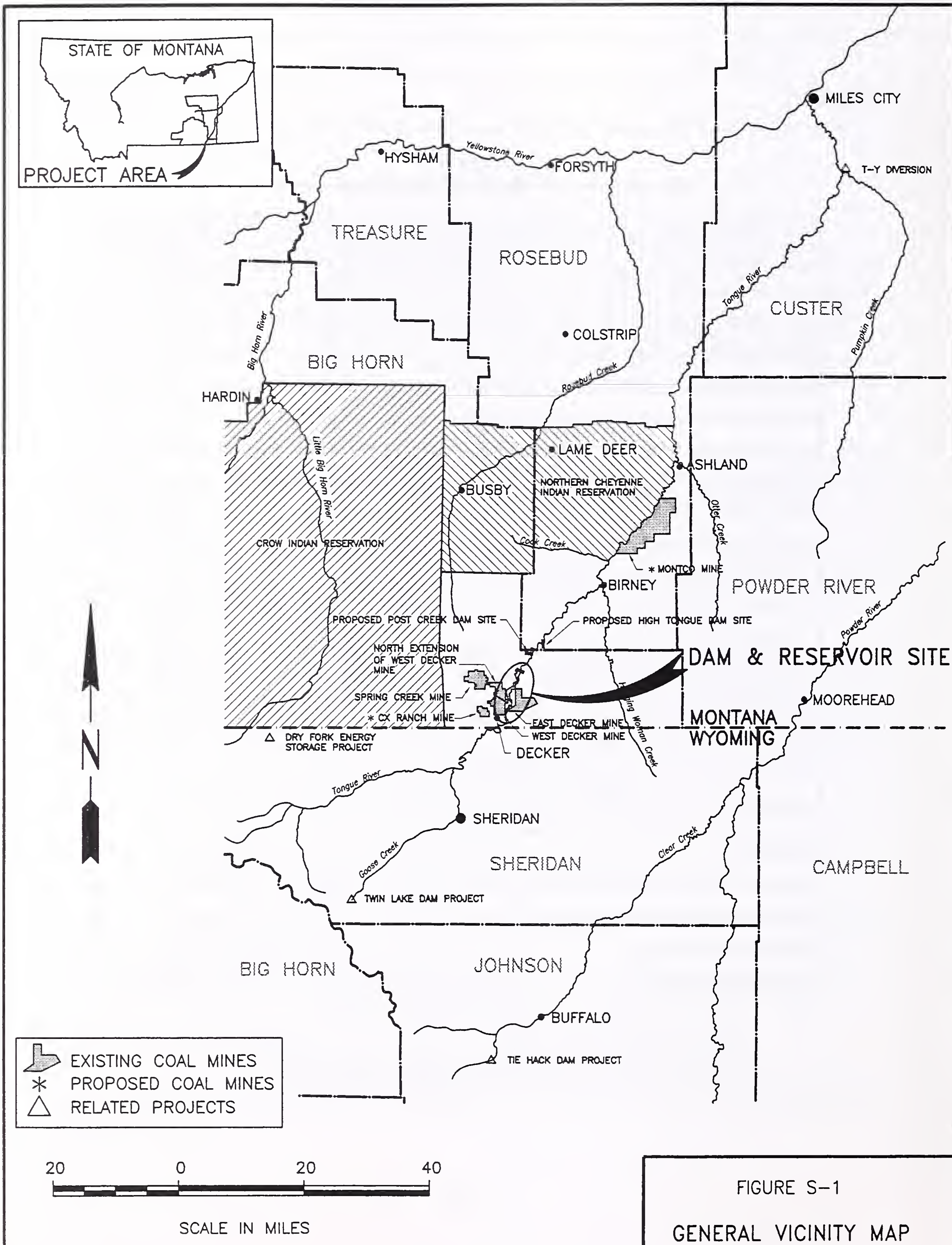


FIGURE S-1

GENERAL VICINITY MAP

Tongue River Reservoir is located in the Tongue River Valley where topography ranges from the flats along the river to surrounding steep and eroded terrain. The reservoir is about 8 miles long and 1 mile wide, with an average depth of 20 feet. From the reservoir, the river flows northeast about 190 miles to its mouth on the Yellowstone River at Miles City. The southern boundary of the Northern Cheyenne Indian Reservation lies about 15 miles north of the dam. The Tongue River and its tributaries are the major sources of surface water in the area.

The reservoir and river support a variety of fish -- mostly warm-water species. Riparian vegetation along the river and on some locations around the reservoir provides habitat for both large and small mammals and some game species. Waterfowl and some threatened and endangered species such as bald eagles inhabit the reservoir area and the river corridor.

Primary land use around the reservoir and in the Tongue River Basin is agriculture. The mining, agriculture, government, and services sectors provide the majority of basin employment. Recreational use of Tongue River State Park, located on the west shore of the reservoir, has increased steadily since 1989, reflecting the popularity of the park as a regional recreational resource. Boating, fishing, and camping are the primary activities at the state park. A more detailed description of all resources in the project area is provided in the draft EIS.

ENVIRONMENTAL CONSEQUENCES

Table S-2 presents a comparison of the principal impacts that would occur under the two action alternatives. Alternative 3, (no action) is not included since impacts would be negligible without the project, except in the case of dam failure. Impacts of the two action alternatives, as presented in **Table S-2**, are similar with the exception of the following:

- *Hydrology*. Peak outflow under Alternative 1 would increase over existing conditions. There would be no appreciable change in peak discharges from design floods under Alternative 2.

- *Aquatics/Fisheries*. If a bypass were used instead of an auxiliary outlet works under Alternative 2, impacts to aquatics/fisheries would occur during shutdowns for spillway repair. Under this scenario, impacts to aquatics/fisheries could be minor to major and significant depending on the timing and duration of the shutdown.

- *Vegetation*. Increased flood flows associated with Alternative 1 could favor maintenance of downstream riparian communities while Alternative 2 would approximate existing conditions. The excavation of aggregate for construction would destroy up to 60 acres of vegetation under Alternative 1 and up to 30 acres of vegetation under Alternative 2.

- *Aggregate Material Sources*. Alternative 1 would require the mining of aggregate at Site No. 1 while Alternative 2 would require sites 1 and 2 to be mined.

- *Construction Employment*. Employment required during the construction of Alternative 1 would be slightly higher than for Alternative 2. Wages and salaries are estimated at $1.9 million for Alternative 1 and $1.7 million for Alternative 2.

- *Appearance*. Alternative 1 would differ in appearance from the existing spillway due to its zigzag crest. Alternative 2 would have a different dam embankment profile than the existing dam due to the secondary and emergency spillways.

- *Project Cost*. Alternative 1 is estimated to cost 50 percent more than Alternative 2.

TABLE S-2
Comparison of Principal Impacts by Action Alternative and Resource[1]

IMPACT TOPIC	ALTERNATIVE 1 (Labyrinth Weir)	ALTERNATIVE 2 (RCC)
SOILS		
Impacts to soil productivity in project-related surface disturbance areas	Moderate to major over the short term and minor over the long term	Same as Alternative 1
HYDROLOGY		
Impacts on reservoir elevations and storage from proposed reservoir operations	Major and significant in the short term and major, beneficial and significant in the long term	Same as Alternative 1
Downstream impacts of the 100-year flood event	Moderate to major and significant in the short and long terms	Negligible in the short and long terms
Note: Dam Failure would result in impacts moderate to major and significant in the short and long terms		
AQUATICS/FISHERIES		
Impacts of construction-related drawdown and reduced pool capacity on reservoir fisheries	Minor to moderate in the short term and negligible to minor in the long term with the potential to become major and significant	Same as Alternative 1
Impacts of reduced downstream releases during construction on river aquatic life	Minor in the lower reach of the river and minor to moderate immediately below the dam in the short term	Same as Alternative 1, except if a bypass were used during rehabilitation of the outlet works, impacts immediately below the dam would be major with the potential to become significant in the short and long terms.

[1] Qualitative terms are used to describe anticipated magnitude of impacts and, where appropriate, anticipated importance of impacts to the human environment. The terms "major", "moderate", "minor", and "negligible" describe magnitude. "Significant", "potential to become significant", and "insignificant" describe importance. Impacts are assumed to be insignificant unless otherwise identified.

TABLE S-2 (Cont.)

IMPACT TOPIC	ALTERNATIVE 1 (Labyrinth Weir)	ALTERNATIVE 2 (RCC)
WILDLIFE		
Impacts on terrestrial wildlife from increased reservoir water levels	Moderate to major and significant in the short term and minor in the long term	Same as Alternative 1
VEGETATION		
Impacts on vegetation from project-related road construction	Minor in the short and long terms, but if weeds became established, major in the short and long terms	Same as Alternative 1
Impacts on vegetation from state park relocation	Minor in the short and long terms, but if weeds became established, major in the long term	Same as Alternative 1
Impacts on vegetation at the construction staging area	Major in the short term and minor in the long term	Same as Alternative 1
ECONOMIC CONDITIONS		
Impacts on public sector fiscal conditions from project construction and operations	Minor in the short term on local government. Significant in the short term on state and federal governments, and potentially significant and beneficial in the long term	Same as Alternative 1
Note: Dam Failure would result in moderate to major and significant impacts in the short and long terms		
RECREATION		
Impacts to state park access from project construction and operation	Moderate to major in the short term and negligible in the long term	Same as Alternative 1
Impacts to recreation experience from project construction and operation	Moderate to major in the short term and negligible to minor in the long term	Same as Alternative 1
Short-term impacts to boating opportunities and navigational safety from construction drawdown	Moderate in the short term and minor to moderate in the long term	Same as Alternative 1
Note: Dam Failure would result in moderate to major and significant impacts in the short and long terms		

Except in the case of dam failure, the selection of Alternative 3 (no action) would result in negligible impacts for all topics and resource areas. Under Alternative 3, the dam would continue to have an unacceptable risk of failure. Dam failure would result in moderate to major and significant impacts to hydrology, social and economic conditions, and recreation. Dam failure would pose a threat to human life and property. Economic losses from dam failure are estimated at $300 to $500 million and the resulting damage to fish and wildlife habitat could take up to 40 years to recover fully.

This draft EIS also analyzes the probable cumulative impacts that would occur from the proposed alternatives in combination with other projects and activities proposed for the area in the reasonably foreseeable future. The other proposed projects and activities included in the cumulative impacts analysis were: the Tongue River Railroad Project, state highway improvements, Twin Lakes Dam Project, Tie Hack Dam Project, Dry Fork Energy Storage Project, and Tongue River State Park improvements.

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

Page

TABLE OF CONTENTS (Continued)

Page

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

Page

TABLE OF CONTENTS (Continued)

LIST OF TABLES

LIST OF FIGURES

LIST OF FIGURES (Continued)

PREFACE

The purpose of an environmental impact statement (EIS) is to provide the information, background, and facts necessary for individuals/agencies to make informed decisions regarding a proposed project (in this case the Tongue River Basin Project). An EIS is not usually read like a book, from the first page to the end. The best way to go about reading an EIS depends on your interests. You may be more interested in impacts, while others might have more interest in the details of the proposed plan or opportunities made available for public involvement in the environmental assessment process. Many readers probably just want to know what is being proposed and how it would affect them.

The following paragraphs outline information contained in the chapters and appendices so that readers may find the parts of interest without having to read the entire document.

The **Summary** is a short, simple discussion to provide the reader and the decision makers with a sketch of the more important aspects of the EIS. The reader can obtain additional, more detailed information from the text of the EIS.

Chapter 1 is the first section of the EIS. It introduces the reader to the project, the agencies involved, and the underlying purpose of, and need for the project and the EIS.

Chapter 2 identifies the significant issues associated with the project, the pertinent components of alternatives analyzed in Chapter 4, and presents mitigation. All other alternatives, considered but not analyzed, are identified along with the rationale for not including them in the analysis. A presentation of other reasonably foreseeable projects that may have impacts in combination with the Tongue River Basin Project is made in this chapter. Chapter 2 also provides a comparative summary of the environmental impacts of the primary alternatives to provide a clear basis of choice among options for the decision maker and the public.

Chapter 3 describes the current condition of resources that are expected to be affected by the alternatives under analysis in Chapter 4.

Chapter 4 is the most important section of the EIS. This chapter contains the discussion of expected impacts to the human and physical environment, both with and without the project.

Chapter 5 lists the agencies and companies consulted during the preparation of the EIS and describes opportunities made available for public participation.

Chapter 6 lists interdisciplinary team members responsible for preparation and review of the EIS.

Chapter 7 is a glossary of technical or unusual terms used in the EIS.

Chapter 8 lists references cited in the EIS.

Appendix A provides a complete list of environmental laws and regulatory authorities applicable to the Tongue River Basin Project.

Appendix B is the biological assessment of threatened and endangered species, as well as species proposed for listing as threatened or endangered (candidate species), of plants and animals that may occur on or near the project area.

Appendix C provides the project sponsors' proposed plan for the enhancement of fish and wildlife habitat in the Tongue River Basin.

Appendix D lists the Montana and federal ambient air quality standards applicable to the Tongue River Basin Project.

Appendix E explains the hydrologic data for the Tongue River Basin Project.

Appendix F lists the mammals, amphibians, reptiles, fish, and birds species observed in the Tongue River Dam Area.

LIST OF ABBREVIATIONS AND ACRONYMS

ACHP: Advisory Council on Historic Preservation

afy: acre-feet per year

AVF: Alluvial Valley Floor

BIA: Bureau of Indian Affairs

BLM: Bureau of Land Management

BN: Burlington Northern

CFR: Code of Federal Regulations

cfs: cubic feet per second

CHR: Community Health Representative

COE: U.S. Army Corps of Engineers

dBA: A-weighted decibels

DFWP: Department of Fish, Wildlife and Parks

DHES: Department of Health and Environmental Sciences

DNRC: Department of Natural Resources and Conservation

DSL: Department of State Lands

EAP: Emergency Action Plan

EIS: Environmental Impact Statement

EMT: Emergency Medical Technician

EMTD: Emergency Medical Technician certified to operate defibrillator equipment

EPA: Environmental Protection Agency

FAS: Federal Aid Secondary

FHWA: Federal Highway Administration

ft: feet

LIST OF ABBREVIATIONS AND ACRONYMS (Continued)

FY: fiscal year

gpm: gallons per minute

HABS: Historic Architectural Building Survey

HUD: Housing and Urban Development

IHS: Indian Health Service

ISC: Insurance Services Office

Leq: Average noise level

Leq[h]: Leq measured over a 1-hour period

LIHEAP: Low Income Housing Energy Assistance Program

MCA: Montana Codes Annotated

MDT: Montana Department of Transportation

MEPA: Montana Environmental Policy Act

mg/1: milligrams per liter

MPDES: Montana Pollutant Discharge Elimination System

MPH: miles per hour

NEPA: National Environmental Policy Act

NHPA: National Historic Preservation Act

NRHP: National Register of Historic Places

PAR: population at risk

PHS: Public Health Service

PM-10: 10 micron or smaller suspended particulates

PMF: probable maximum flood

LIST OF ABBREVIATIONS AND ACRONYMS (Continued)

PMP: probable maximum precipitation

ppm: parts per million

PSD: Prevention of Significant Deterioration

QRU: quick response unit

RCC: roller-compacted concrete

SDF: spillway design flood

SHPO: State Historic Preservation Office

T&Y: Tongue and Yellowstone

TDS: total dissolved solids

TERO Agreement: Northern Cheyenne Labor Relation Accord and Employment Preference Agreement

Tribe: Northern Cheyenne Tribe

TRR(C): Tongue River Railroad (Company)

TSP: total suspended particulates

ug/m^3: micrograms per cubic meter

U.S.C.: U.S. Code

vpd: vehicles per day

USBR: U.S. Bureau of Reclamation

USFWS: U.S. Fish and Wildlife Service

WMA: Wildlife Management Area

CHAPTER 1 PURPOSE AND NEED

1.1 INTRODUCTION

Montana Department of Natural Resources and Conservation (DNRC), in conjunction with the Northern Cheyenne Tribe (Tribe), and United States Bureau of Reclamation (USBR), has prepared this environmental impact statement (EIS), as required under the National Environmental policy Act (NEPA) and the Montana Environmental Policy Act (MEPA), to evaluate the environmental effects of the proposed Tongue River Basin Project in southeastern Montana. This project, which includes the repair and enlargement of the Tongue River Dam and the partial fulfillment of the Northern Cheyenne Indian Reserved Water Rights Settlement Act of 1992 (Settlement Act), is being proposed to alleviate dam safety concerns and protect downstream lives and property, to protect all existing water use contracts held in the Tongue River Reservoir, and to provide up to an additional 20,000 acre-feet of water to the Tribe. An additional component of the project involves the conservation, development, and enhancement of fish and wildlife habitat in the Tongue River Basin. All project goals are components of the Settlement Act, that ratified the Water Rights Compact entered into on June 11, 1991, by the Northern Cheyenne Tribe and the State of Montana. The EIS analyzes three alternatives, including no action, and is being released for review and comment by other agencies and the public. Following the review period and in response to the comments received on the draft EIS, the project sponsors (DNRC, the Tribe, and USBR) will prepare a final EIS and issue a Record of Decision (ROD) identifying the final course of action.

1.2 LOCATION

Tongue River Dam and Reservoir are located in Big Horn County in southeastern Montana, about 5 miles from the Montana/Wyoming border **(see Figure 1-1)**. The nearest towns are Ashland, Montana and Sheridan, Wyoming, 60 and 30 miles away, respectively.

The Tongue River flows about 100 miles from its headwaters in Wyoming's Bighorn Mountains to the project area. The area is located in the Tongue River Valley, formed when the river and its tributaries eroded through parts of the Fort Union Formation. Area topography ranges from the flat river valley and benches to surrounding steep and eroded terrain. The reservoir is about 8 miles long and 1 mile wide with an average depth of 20 feet. From the reservoir, the river flows northeast about 190 miles to its mouth on the Yellowstone River at Miles City. The dam was completed in 1940 and was administered by the Montana Water Conservation Board until 1972 when that responsibility was passed on to DNRC.

The southern boundary of the Northern Cheyenne Reservation lies about 15 miles north of the dam. The Northern Cheyenne Indian Reservation encompasses 466,469 acres located in southeastern Montana. The reservation was created through executive orders in 1884 and 1900. Tongue River and Rosebud Creek are the principal drainages on the reservation.

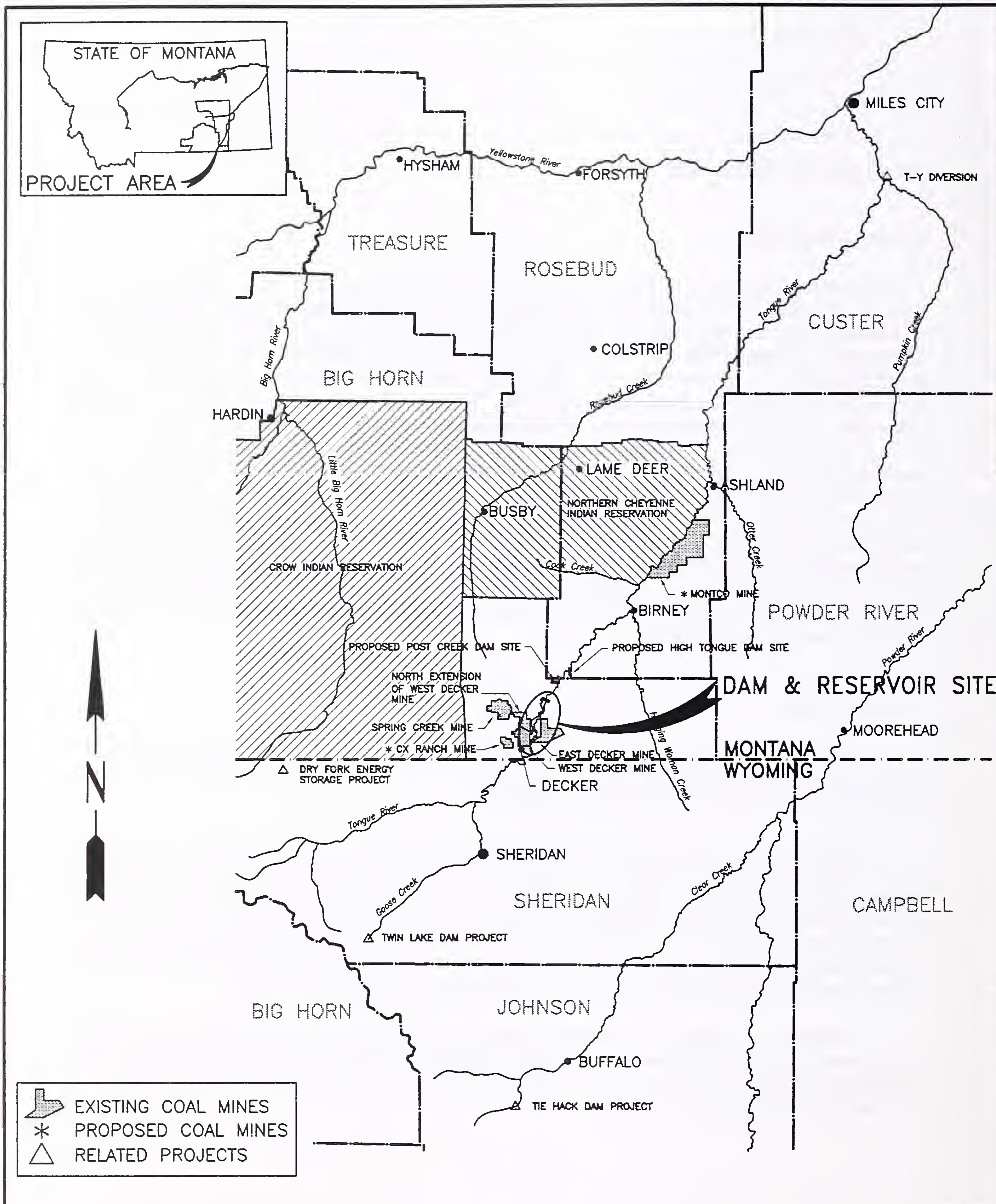


FIGURE 1-1

GENERAL VICINITY MAP

1.3 BACKGROUND

In 1913, the state court of Montana initiated a proceeding to adjudicate water rights on Tongue River. In this proceeding, the federal government did not fully satisfy the Northern Cheyenne Tribe's Winters rights claims[1] to water in the Tongue River. Instead, the United States asserted a claim on behalf of the Tribe only for the amount of water used by the Tribe at that time. In the Miles City Decree of 1914 (the Decree), the Tribe was awarded only 30 cubic feet per second (cfs) of water out of an available 425 cfs. The Decree established a priority date of 1909 for the Northern Cheyenne water claim; the next to last priority awarded in the Decree. The Tribe's water right as set forth in the Decree was insufficient to irrigate the Tribe's agricultural lands at the time and the late priority date established a high probability that the Tribe would be out of water before the irrigation season began.

The Tribe has asserted that the failure to pursue the Tribe's Winters rights claims constituted a breach of the federal trust responsibility. In 1975, the Tribe filed an action in U.S. District Court to determine its water rights. The United States also filed suit on behalf of the Tribe. In 1979, the State of Montana initiated proceedings for a general stream adjudication which included the claims of the Tribe. In that same year, the state established the Montana Reserved Water Rights Compact Commission to negotiate a water rights settlement with the Indian tribes of Montana. Negotiations with the Tribe began in 1980. Several years of negotiations yielded the Northern Cheyenne-Montana Water Rights Compact (the Compact). The Tribe formally approved the Compact on May 20, 1991, with Tribal Resolution #144. The Compact was ratified by the Montana State Legislature on June 11, 1991, and was re-ratified on December 16, 1993 by the 53rd Legislature Special Session.

On September 30, 1992, the federal government ratified the Compact via "The Northern Cheyenne Indian Reserved Water Rights Settlement Act of 1992" (P.L. 102-374, 106 Stat. 1186) (Settlement Act). The purposes listed in the Settlement Act are as follows:

> "To achieve a fair, equitable, and final settlement of all claims to Federal reserved water rights in the State of Montana of the Northern Cheyenne Tribe and its members and allotees and the United States on behalf of the Northern Cheyenne Tribe and its members and allotees. To approve, ratify and confirm the Water Rights Compact entered into by the Northern Cheyenne Tribe and the State of Montana on June 11, 1991. To direct the Secretary of the Interior to enter into a cooperative agreement with the State of Montana for the planning, environmental compliance, design, and construction of the Tongue River Dam Project (P.L. 102-374, 106 Stat. 1186, Section.3(8) in order to: implement the Compact's settlement of the Tribe's reserved water rights claims in the Tongue River Basin; protect existing tribal contract water rights in the Tongue River Basin; provide 20,000 acre-feet per year of additional storage water for allocation to the Tribe; and allow the State to implement its responsibilities to correct identified Tongue River Dam safety inadequacies. To provide for the conservation and development of fish and wildlife resources in the Tongue River Basin. To

---

[1] In *Winters v. United States*, 207 U.S. 564, 577 (1908) the Supreme Court held that when the federal government set aside lands for a particular purpose, it also reserved, by implication, enough of the then unappropriated water on or adjacent to that land to satisfy the purposes of the reservation. In *Arizona v. California*, 373, U.S. 546, 600 (1963) the Court established the general rule that a Winters right for an Indian reservation is to be determined by reference to the "practically irrigable acreage" on the reservation.

provide for the enhancement of fish and wildlife habitat in the Tongue River Basin. To authorize certain modifications to the purposes and operation of the Big Horn Reservoir in order to implement the Compact's settlement of the Tribe's reserved water rights claims. To authorize the Secretary of the Interior to take such other actions as are necessary to implement the Compact."

Reclamation was directed to assume lead federal agency responsibility for environmental compliance activities on the Tongue River Basin Project and the uses of the Tribe's Big Horn Reservoir water supply. This document will focus on evaluation of the Tongue River Basin Project. Environmental compliance activities for the use of the Tribe's Big Horn Reservoir was deferred until the Tribe identifies a use for that water. The Settlement Act imposed a 10-year moratorium on the marketing of the Tribal water supply stored in the Big Horn Reservoir, unless the Crow Tribe and the Northern Cheyenne agree otherwise.

The Settlement Act allocated $4.6 million for enhancement of fish and wildlife habitat in the Tongue River Basin. The funds are provided pursuant to P.L. 89-72, with a cost-share arrangement of $3.5 million in federal funds and $1.1 million in state funds.

Negotiation of the Compact and signing of the Settlement Act were carried out in advance of NEPA compliance. However, the Settlement Act specifically directed the Secretary of the Interior to comply with NEPA and the Endangered Species Act during implementation. To comply with that directive, it is necessary to evaluate not only the actions contained in the Settlement Act, but all other reasonable alternatives that meet the purpose and need of the Act.

1.4 PURPOSE AND NEED

Although federal (U.S. Bureau of Reclamation) and state (Department of Natural Resources and Conservation) concerns about the Tongue River Basin Project are basically the same--satisfaction of tribal water rights and dam safety--each agency has different legal obligations to satisfy. The federal purpose of the Tongue River Basin Project is to protect the following Indian Trust Assets: 1) the Northern Cheyenne Tribe's existing water supplies held in the Tongue River Reservoir, 2) the safety of downstream tribal lives and lands, and 3) additional water for the Tribe's use in the Tongue River Basin. An additional purpose of the project is to provide for the conservation, development, and enhancement of fish and wildlife resources and habitat in the Tongue River Basin.

From the federal government's perspective, the need for the Tongue River Basin Project is as follows: the Tribe currently does not have sufficient water to satisfy the Tribal water right recognized in the Compact; tribal life and lands are endangered by the unsafe Tongue River Dam located upstream of the reservation; and fish and wildlife resources and habitat in the Tongue River Basin have suffered as a result of human development of the area.

Indian Trust Assets are legal interests in property held in trust by the United States for Indian tribes or individuals. The federal government has a trust responsibility to protect and maintain rights reserved by or granted to Indian tribes or Indian individuals by treaties, statutes, executive orders, and other agreements entered into by Department of the Interior.

Reclamation has identified the protection of trust assets of the Tribe as the federal action requiring NEPA compliance for the Tongue River Basin Project. The State of Montana has an interest in the Settlement Act because it fulfills the water rights compact between the Tribe and the state, and because it provides for the repair of the state-owned Tongue River Dam. DNRC is the state agency responsible for the dam. The EIS will also address DNRC's responsibilities under MEPA.

The purpose for the State of Montana's action to be addressed under MEPA is: 1) to maintain the ability to deliver all existing water use contracts held in the Tongue River Reservoir; 2) to provide a safe dam to protect lives and property downstream; and 3) to provide increased reservoir storage that, in combination with exchange water and existing unallocated reservoir storage, would allow for the delivery of up to an additional 20,000 acre-feet of water to the Tribe. The state believes the action is necessary because: 1) the Tongue River Dam is unsafe, and 2) the Northern Cheyenne-Montana Water Rights Compact requires Montana to deliver up to 20,000 acre-feet of storage and exchange water to the Tribe over and above the Tribe's existing water purchase contract for 7,500 acre-feet.

1.5 APPLICABLE LAWS, REGULATIONS AND AGENCY INVOLVEMENT

Appendix A provides a detailed discussion of environmental laws, regulations, and agency involvement applicable to this project.

CHAPTER 2 ALTERNATIVES

2.1 INTRODUCTION

This chapter contains five parts. Development of Alternatives and Significant Issues explains how the project sponsors -- Department of Natural Resources and Conservation (DNRC), the Northern Cheyenne Tribe (Tribe), and Bureau of Reclamation (USBR) -- developed alternatives analyzed in this draft EIS. Description of Alternatives describes three alternatives, including the no-action alternative. Alternatives Considered but Dismissed describes alternatives considered but dismissed from detailed analysis in this draft EIS. Reasonably Foreseeable Activities discusses the reasonably foreseeable future activities included in the cumulative impact assessment. Comparison of Alternatives displays the alternatives so that their respective features and impacts can be compared.

At the initiation of environmental impact statement preparation, the project sponsors had not identified a preferred alternative. After completion of the environmental analysis contained in this document, the project sponsors identified Alternative 2, the Roller-Compacted Concrete (RCC) Spillway with an auxiliary outlet works, as the preferred alternative.

2.2 DEVELOPMENT OF ALTERNATIVES, AND SIGNIFICANT ISSUES

Once the project sponsors had identified the purpose and need for the project (see Chapter 1, Purpose and Need) they began a process of developing alternatives. At the outset, alternatives were limited by the multipurpose needs of the project. Alternatives being considered needed not only to address dam safety and repair, but also satisfy the Tribe's water right, and include fish and wildlife enhancement activities.

In March 1993, the project sponsors held public scoping meetings to aid in alternatives identification. Comments from nine scoping meetings (see Chapter 5, Public Involvement) contributed to the project sponsors' issues identification process. From this, refinement of alternatives and proposed mitigations was made to ensure that public and project sponsor issues were addressed.

USBR and DNRC also began determining the least-cost method of fixing the dam, because only one structural plan -- a labyrinth weir spillway -- was being considered at the time. USBR analyzed different spillway designs. Criteria for the spillway included: raising the spillway crest elevation 4 feet, passing the spillway design flood (SDF) of 100,000 cfs without overtopping the dam embankment, or flooding the coal strip mines at the south end of the reservoir. The RCC alternative emerged from this analysis.

The addition of hydropower generation equipment to the Tongue River Dam was investigated by Tudor Engineering, Inc. (1982) and DNRC (1994). The evaluation concluded that the cost of modifications to the dam and installation of hydropower equipment versus the amount of potential revenue from energy that could be generated would not be cost-effective at today's energy rates.

Alternatives that are carried forward in this EIS are discussed under Description of Alternatives. Other alternatives are discussed under Alternatives Considered but Dismissed. The object was to isolate the

most technically sound and cost-effective alternative(s) that satisfied the Settlement Act. The labyrinth weir and RCC designs were retained because of their ability to address all three concerns: cost, technical soundness, and water rights. Although the two action alternatives achieve the same purposes, construction and design are different for each, and each has slightly different physical effects associated with it.

2.2.1 Identification of Significant Issues

The project sponsors carried out a public involvement plan as discussed in Chapter 5. From meetings held in accordance with the plan, the public identified issues and concerns regarding this project.

From issues identified at those meetings and by agency staff, the project sponsors and the interdisciplinary team responsible for preparation of the EIS identified significant issues that would be used to drive the alternatives formulation (including proposed mitigations). Significant issues define effects that have the potential to be severe or long-lasting; affect a large area; or occur frequently when a resource's quantity, quality, fragility, or uniqueness are considered. Issues under four resource areas emerged from the scoping process and project sponsors' evaluations.

2.2.1.1 Aquatics/Fisheries

Effects on aquatic resources within the reservoir and river upstream and downstream of the reservoir

- Drawdown of reservoir levels during construction could result in large scale mortality of fish in the reservoir. Effects will be predicted from changes in the critical physical and chemical parameters in the aquatic habitat.

- Drawdown of the reservoir could cause the loss of immature and smaller fish due to predation; there would be a higher concentration of fish per volume of water. Drawdown could also limit fish reproduction and survival rates and result in greater losses of fish drawn through the outlet works. Effects will be predicted based on results observed in similar circumstances in the aquatic environment.

- The one-time short-term reduction of flows (to 25 cfs for no more than 2 weeks) in the Tongue River downstream of the dam during construction could result in partial mortality of some aquatic life within affected portions of the river. This could result from exposure of the normally wetted stream substrate and increased predation due to concentration of aquatic life. Effects will be measured by estimating the extent of mortality if flow dropped below the average run-of-river flows into the reservoir.

- Short-term impacts to aquatic life could occur from reduced flows in the river and related temperature increases during summer months and increased turbidity and sedimentation during construction. Reduced flows in the river during winter months also could result in anchor-ice (freezing from the streambed up) formation and accompanying scouring of the river bottom in riffle areas during spring thaw. Depending on the extent of occurrence in the river, reduced biological productivity could occur. Effects will be measured by estimating

the extent of mortality if flow dropped below the average run-of-river flows into the reservoir.

- Long-term (following project construction) effects on aquatic life would occur in the river upstream of the dam due to inundation of about 1 mile of river habitat and its replacement by reservoir conditions. Effects will be predicted based on results observed in similar circumstances in the aquatic environment.

2.2.1.2 Hydrology

Effects on the water rights settlement with the Northern Cheyenne Tribe

- Either of the action alternatives provides the means to satisfy the Settlement Act required water right with the Tribe for up to 20,000 acre-feet[1]. Without the project, DNRC would not be able to satisfy this legal requirement as set forth in the Settlement Act. Sedimentation within the reservoir and its impact on the Tribal water right is addressed in the Water Compact.

Impacts of Flood Events

- The characteristics of discharges from common flood events could change, affecting downstream channel form. The changes will be measured by estimated differences in the characteristics of peak flood discharges.

- The characteristics of flood discharges from the 100-year flood could change compared to existing conditions. The changes will be measured in terms of estimated flood peak and topwidth, downstream floodplain size, and flood depth.

2.2.1.3 Socioeconomics

Effects on Decker Coal Mines Adjacent to the Reservoir

- Ground water seepage into coal mine pits could increase after construction due to increased water elevation in the reservoir. This could negatively impact coal recovery and mine operation. The impact will be measured by the increased rate of ground water seepage into coal mine pits and associated costs.

---

[1] To satisfy the terms of the Northern Cheyenne - State of Montana Water Rights Compact, the rehabilitation and enlargement of the Tongue River Reservoir would allow the Northern Cheyenne Tribe to divert up to 20,000 acre-feet per year (afy) from a combination of water stored in the reservoir and exchange water. A second component of the Compact allows the Tribe to divert up to 12,500 afy from the direct flow of the Tongue River. These rights (storage and exchange water from the enlarged reservoir and direct flows from the river) would be in addition to the existing Tribal water purchase contract for 7,500 afy (see **Appendix** E).

Effects of dam failure on human safety and property downstream of the project

- Since 1978, DNRC has operated the dam at a reduced level due to concerns about hydraulic and structural adequacy of the spillway (Department of Natural Resources and Conservation 1981, 1991). If spillway failure occurred, towns and ranches in the Tongue River Valley would suffer significant damage. There also would be the possibility for loss of life. Fish and wildlife habitat could take from 1 to 10 years to recover and mature vegetation even longer. Economic losses from dam failure are estimated at $300 to $500 million, and reserved water rights could not be met. Recreation use totaling more than 25,000 visitor-days would be lost (Northern Cheyenne Tribe, Montana Department of Natural Resources and Conservation, and U.S. Bureau of Reclamation 1992). Economic losses and human safety risks have already been estimated.

Indian Trust Assets/Federal Trust Asset Responsibility

- The project sponsors' alternative analyses were guided by consideration of whether there was an ability to protect Indian Trust Assets. In this case, those assets included the ability to supply up to 20,000 acre-feet of water storage in addition to the Tribe's existing water supplies, the safety of downstream tribal lives and lands, possible effects on ethnobotanical resources, possible effects on wildlife and fisheries, possible effects on cultural resources, and possible beneficial effects on natural systems addressed by enhancement measures.

Impacts to state and federal governments from the cost of construction

- The costs of a number of alternatives were analyzed to minimize the fiscal impact of dam repair on governmental agencies and ultimately, taxpayers. The two action alternatives appear to be the most cost-effective in achieving the purpose and addressing the need of the project. Costs to state and federal government agencies have already been estimated (Northern Cheyenne Tribe, Montana Department of Natural Resources and Conservation, and U.S. Bureau of Reclamation 1992).

2.2.1.4 Recreation

Short-term effects on recreation resources

- Effects on the fishing access site below the dam, restricted use of state park facilities, and temporary restrictions of shoreline access for walking and off-road vehicle use in the vicinity of the proposed construction staging area would occur during construction. Effects will be measured by comparing existing access, visitor-hours, and disbursement at the state park to estimated changes in access points, visitor-hours, and disbursement as a result of the project.

- Construction drawdowns would increase boater exposure to navigational hazards (e.g., sandbars, dead trees, debris). In addition, existing docking and launching facilities would be temporarily unusable and ultimately relocated. Effects of navigational hazards will be measured by calculating the period of time that hazards, such as submerged debris and

exposed mudflats, would likely be encountered because of fluctuating water levels as a result of the project. Effects of drawdown on boating opportunities will be measured by comparing existing total boating hours to estimated changes in total boating hours as a result of the project.

- Short-term reduction in the quality of the recreational experience would result from increased noise and dust associated with construction activity, restricted access, and loss of use of facilities during construction. Effects will be measured by comparing existing visitor experiences at the state park to estimated changes in recreational experiences.

2.3 DESCRIPTION OF ALTERNATIVES

This section describes three alternatives: two action alternatives (the Labyrinth Weir Alternative, Alternative 1, and the RCC Alternative, Alternative 2) and the no-action alternative. The two action alternatives would repair or replace the Tongue River Dam spillway and raise its crest 4 feet, increasing its safety and allowing the Northern Cheyenne Tribe's reserved water rights from the Tongue River Basin to be satisfied without impacting other water users. Included in both action alternatives is an identical program to enhance fish and wildlife habitat in the Tongue River Basin. A description of the process through which enhancement projects are identified, reviewed, and implemented, as well as a list of projects currently being considered, are included immediately following the description of Alternative 1. Although the action alternatives are referred to throughout the document only by their respective construction design, readers should remember that each also includes fish and wildlife habitat enhancement required by the Settlement Act. The no-action alternative would maintain the status quo. Summaries of the action alternatives were prepared from conceptual design plans on file at DNRC.

2.3.1 Alternative 1 Labyrinth Weir Spillway

The labyrinth weir spillway design incorporates three conventional components of a spillway: ***the crest***, or top of the spillway; ***the chute***, or channel of the spillway; and the ***stilling basin***, or pool at the bottom. The crest of a labyrinth weir spillway looks like a zigzag when viewed from the top (see Figure 2-1). Retaining walls, about 25 feet high, form the accordion-like structure. These walls taper as they rise, from about 5 feet at their base to about 1.5 feet at their top. This crest design is the most efficient in discharging water when compared to other designs of the same width. The crest would be about 250-feet wide but narrower than the existing spillway by 100 feet.

This alternative also would include a new RCC foundation for the spillway and an impervious upstream cutoff wall to prevent seepage beneath the labyrinth weir. The existing foundation would be excavated down to elevation 3,380 feet.

The 500-foot-long chute would be the same width as the crest (250 feet) and would have a smooth face. Water would flow down the chute to a 150-foot-long stilling basin at the toe of the dam (see Figure 2-2). A stilling basin dissipates the energy of fast-flowing water spilling over the dam by routing it to a pool of deep, slow-moving water at the toe of the dam. Dissipating the energy of the fast-moving water prevents erosion of the channel downstream of the spillway. The bottom of the stilling basin would be about 18 feet below

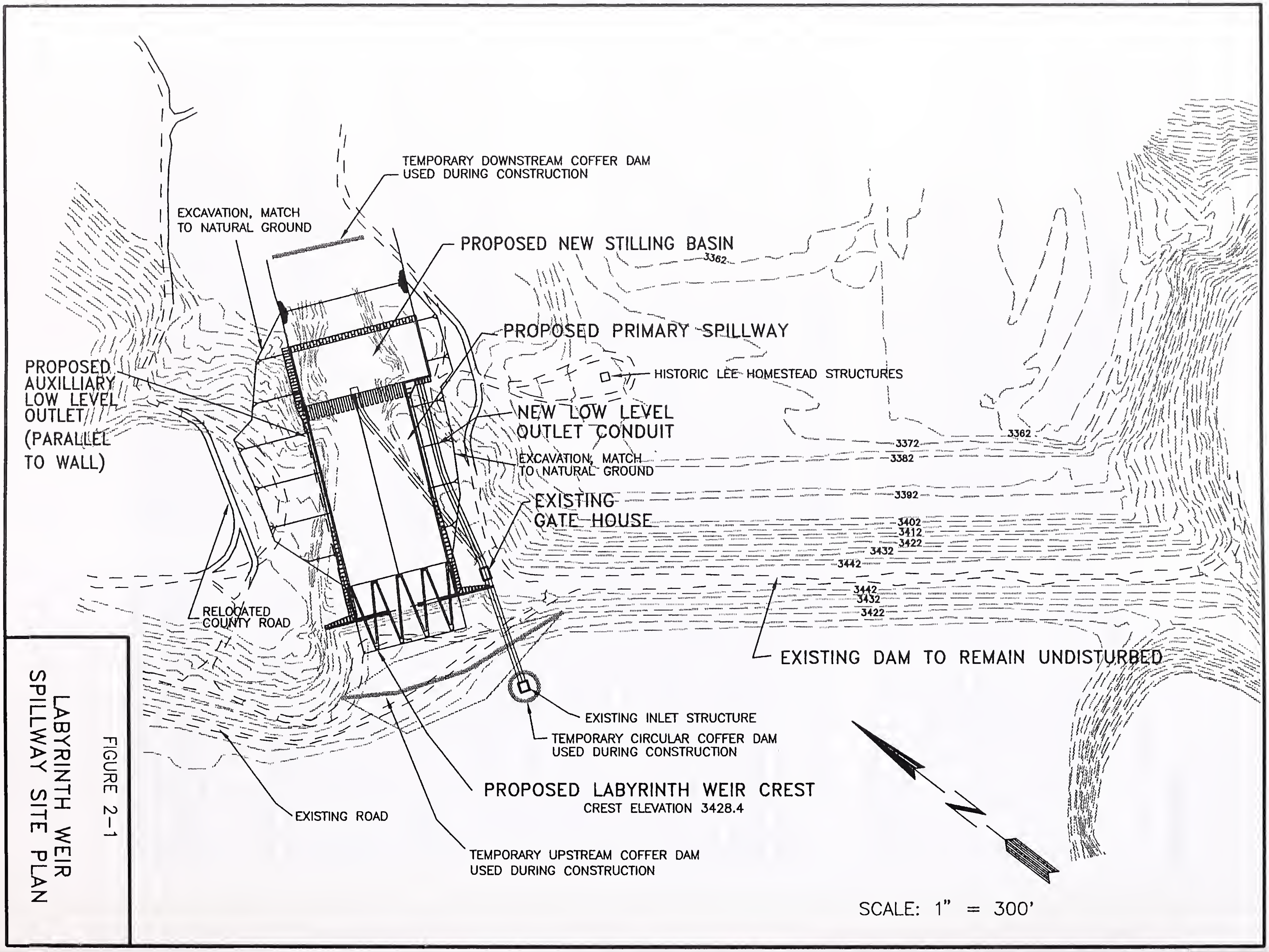


FIGURE 2–1

LABYRINTH WEIR
SPILLWAY SITE PLAN

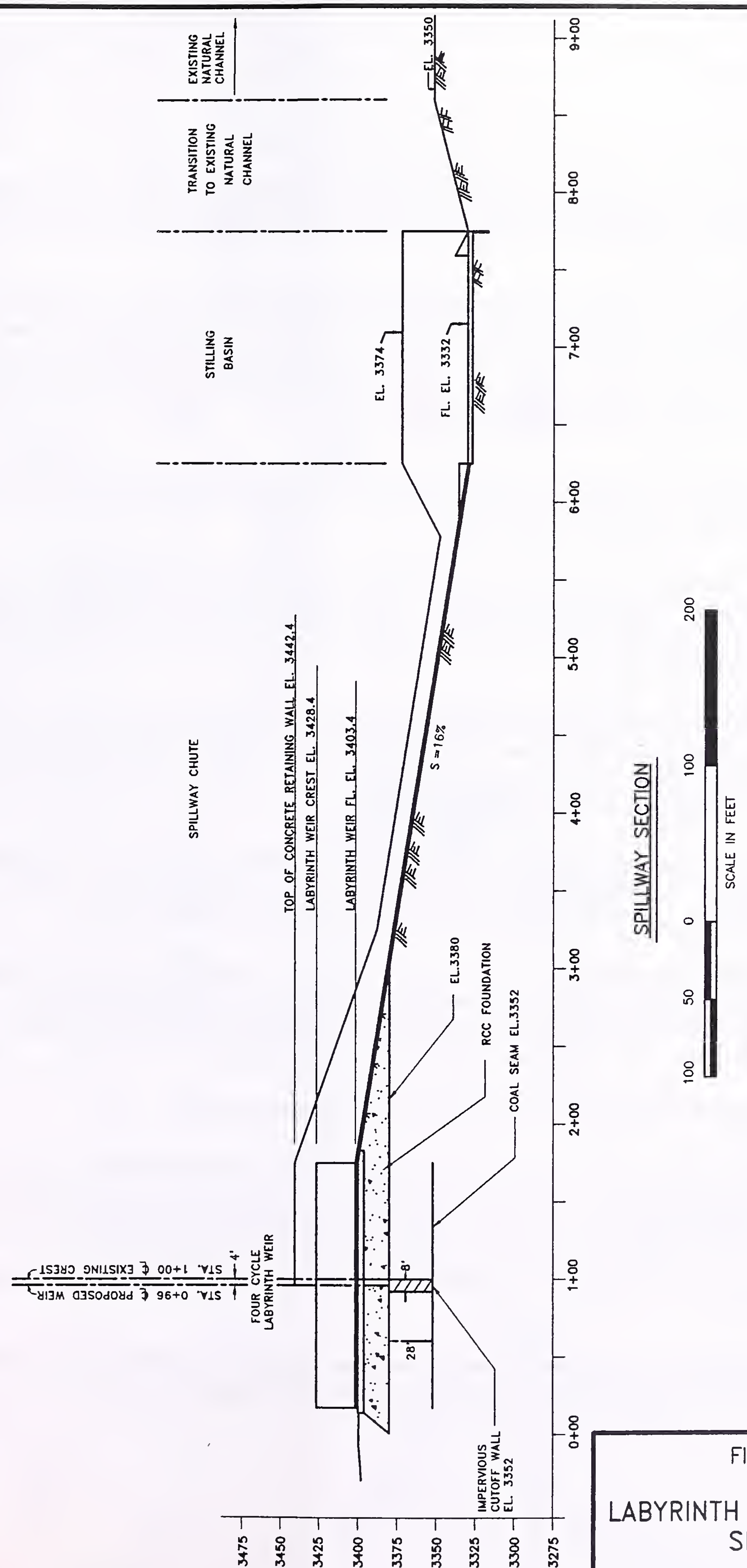


FIGURE 2–2

LABYRINTH WEIR SPILLWAY SECTION

the natural stream channel. Construction of the stilling basin would require passage of water from the outlet works through a flume. This flume would bypass the stilling basin and discharge downstream of a temporary coffer dam (see Coffer Dams).

The reservoir level would be raised 4 feet and the spillway design outflow of 100,000 cubic feet per second (cfs) would be routed through the labyrinth spillway in the left abutment. The 4-feet increase in water surface elevation from 3,424.4 feet to 3,428.4 feet would increase the reservoir capacity from 67,000 acre-feet to 80,000 acre-feet. The reservoir surface area at the new spillway elevation would increase approximately 400 acres from 3,198 acres to 3,612 acres (**see Figure 2-3**).

DNRC would acquire use of land up to elevation 3,440 feet, either by purchasing fee title to it or by acquiring flood easements. Vegetation would not be removed in the land area between the existing water level and proposed reservoir elevation of 3,428.4 feet.

The existing spillway would reduce the 30-day 100-year peak inflow of 25,410 cfs to a discharge of 10,249 cfs to the channel downstream of the project. The average 100-year floodplain width would be about 361 feet and the average depth about 10.4 feet. A comparison of spillway performance at different flood events is shown on **Figure 2-4**.

Peak outflow from the labyrinth weir spillway during the 30-day 100-year flood would be about 18,928 cfs versus 10,249 cfs for the existing spillway. The average 100-year floodplain width would be about 467 feet compared to the existing average floodplain width of 361 feet. The average 100-year floodplain depth would be 13.5 feet or 3.1 feet higher than the existing condition.

The labyrinth weir concept allows a relatively narrow spillway to discharge the 100,000 cfs design flow at an elevation 4 feet below the top of the dam. The labyrinth weir crest structure would require three to four labyrinth cycles. Each "V" in the accordion crest structure is considered a cycle.

The stilling basin area would have to be dewatered during construction because of ground water's proximity to the surface. This would be accomplished by temporary pumps and "well points". Well points are a series of interconnected wells that extract ground water by pumping it up and discharging it, in this case to a settling pond, reservoir, or downstream to augment flows in the river.

2.3.1.1 Construction of a Low Level and Auxiliary Outlet Works

Low level outlet structures allow water to exit the reservoir without flowing over the spillway, but rather through a conduit (tunnel). Portions of the existing low level outlet structure would be rehabilitated and/or replaced, incorporating the existing intake, upstream tunnel, and new gates into the new structure (see **Figure 2-5**). The downstream conduit of the outlet structure would be realigned to make it parallel the spillway to the right. An auxiliary outlet, separate from the primary outlet, would be built to the left of the spillway.

The existing low level outlet works consists of an intake structure in the reservoir with minimum intake elevation of 3,374 feet, a 16-foot-high horseshoe-shaped conduit leading to the gate tower, the gate tower,

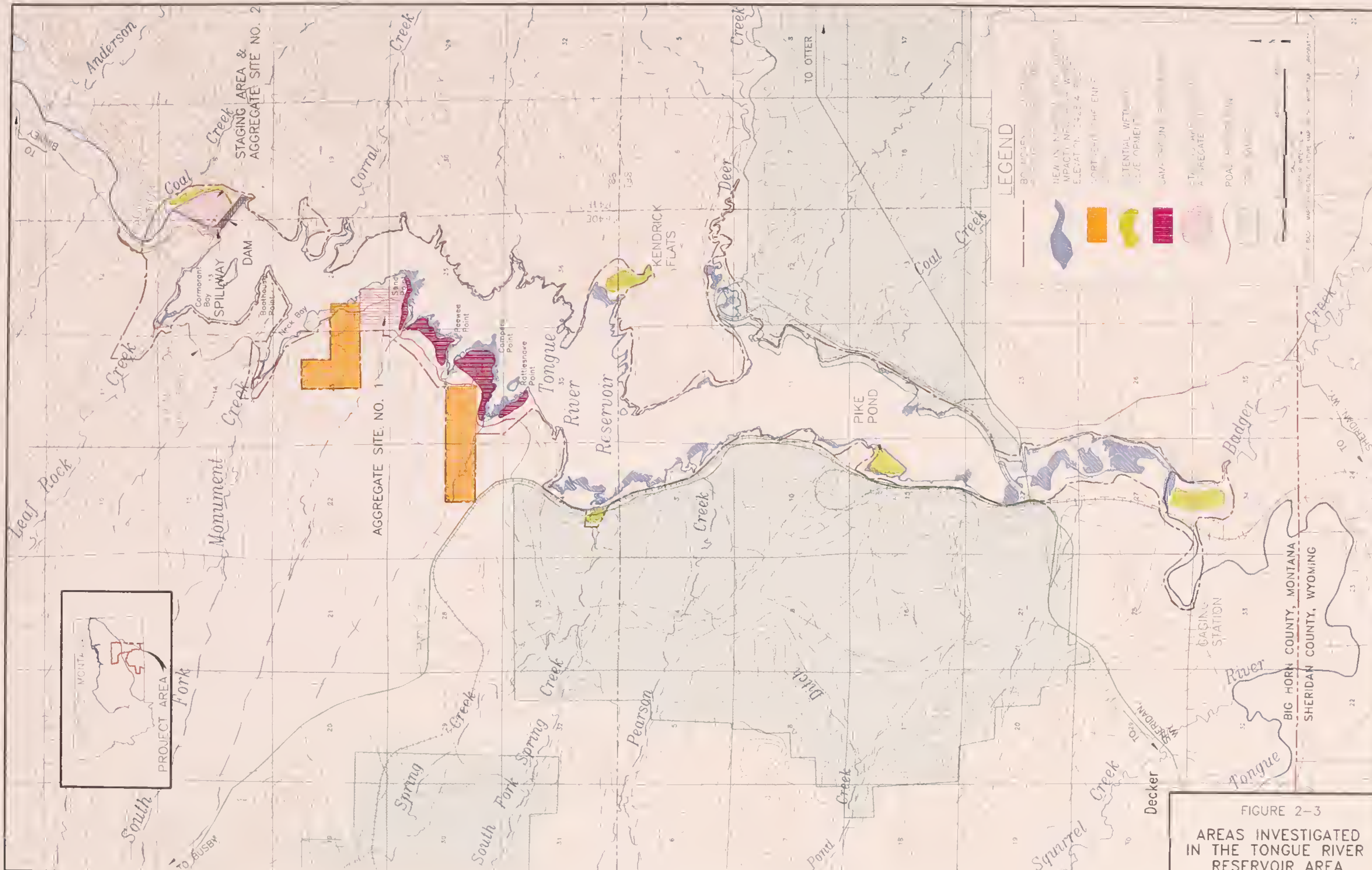


FIGURE 2-3
AREAS INVESTIGATED IN THE TONGUE RIVER RESERVOIR AREA

TONGUE RIVER DAM SPILLWAY ALTERNATIVES

INFLOW AND ROUTED SPILLWAY OUTFLOWS

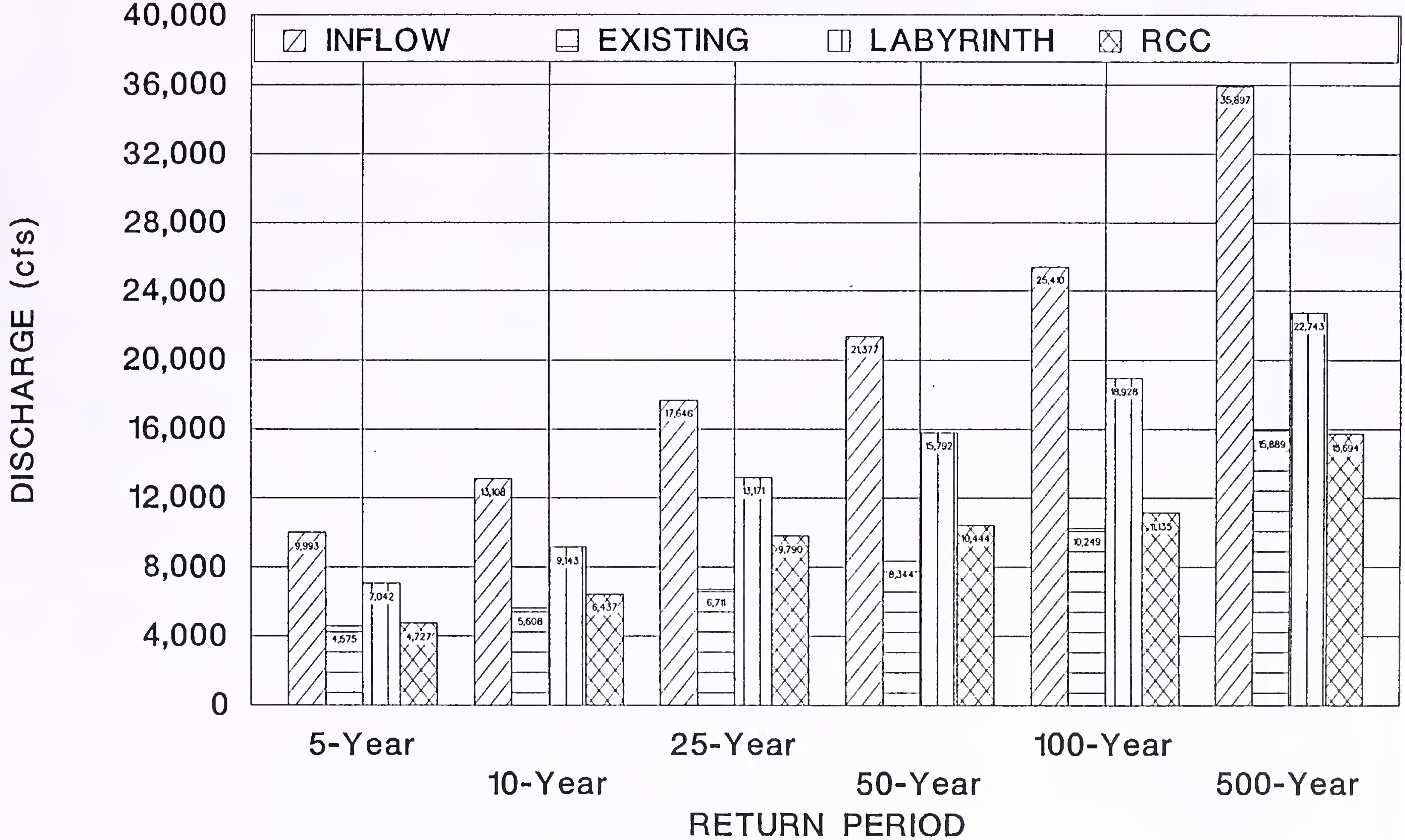
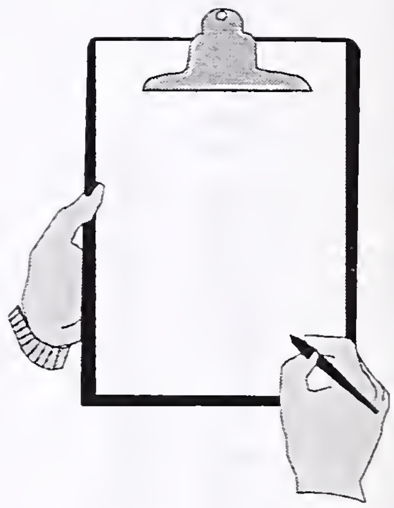


FIGURE 2-4

SPILLWAY OUTFLOWS

THIS PAGE INTENTIONALLY LEFT BLANK



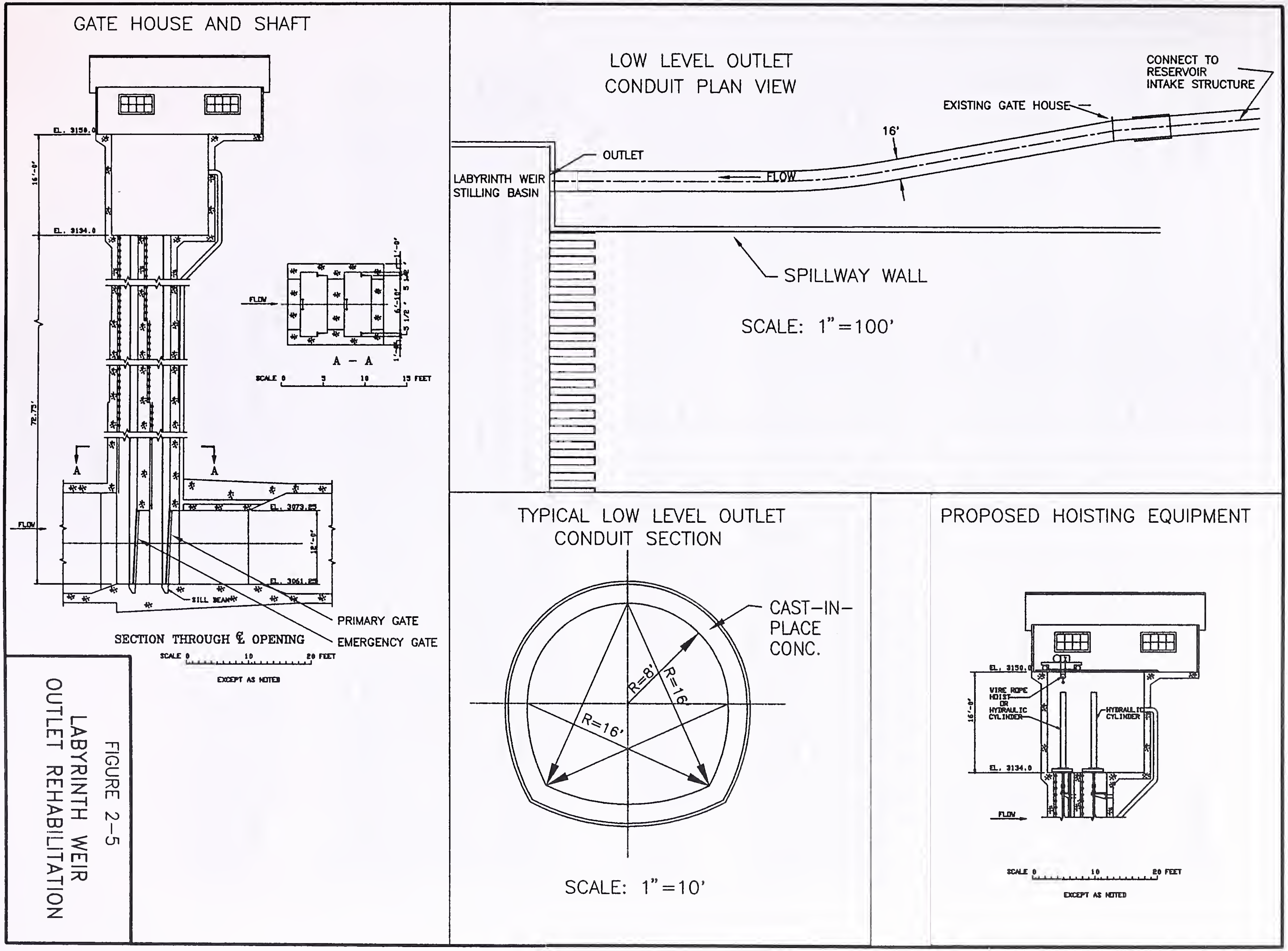


FIGURE 2–5
LABYRINTH WEIR
OUTLET REHABILITATION

and a 16-foot horseshoe-shaped conduit leading to the exit portal in the spillway chute (**see Figure 2-5**). The existing outlet structure has a maximum capacity of approximately 4,000 cfs. Most of this structure is in serviceable condition with the exception of the control gates.

The auxiliary outlet works, with gates on the upstream and downstream ends, would be constructed prior to rehabilitation of the primary works. During construction, a combination of the auxiliary and existing low level outlet works would be used to pass river flows around the project, with one being used as the other was being rehabilitated or constructed. Both low level outlet works would remain in place after the project was completed.

A new or rehabilitated primary low level outlet works would be constructed next. During this stage of construction, temporary stream diversion would take place through the new auxiliary low level outlet works. The new primary outlet would be constructed to the right (east) of the existing spillway and would require the construction of a new downstream conduit connecting to the existing gate tower. The existing 6-foot-wide by 12-foot-high roller gates in the gate tower would be replaced by gates of similar dimensions as shown on **Figure 2-5**. The purpose of the gates is to allow controlled releases from the reservoir. The new primary low level outlet works would have a capacity sufficient to reduce the reservoir from full pool to 25 percent of capacity in 25 days or less (U.S. Bureau of Reclamation reservoir evacuation standards).

Negative pressures downstream of the primary control gate are now experienced during high flows due to the lack of adequate aeration. This lack of aeration has resulted in erosion of the concrete and steel materials in this area. The proposed improvements would include an air shaft to provide sufficient aeration of this area and other hydraulic improvements to prevent this problem.

2.3.1.2 Coffer Dams

A coffer dam is a temporary dam designed to contain and divert water away from a dam, spillway, or outlet during construction. An upstream coffer dam having a crest elevation of 3,426 feet would be constructed to prevent reservoir water up to a 25-year flood event from entering the spillway construction area. This dam would be 45 to 50 feet high and 8 to 12 feet wide at the crest and about 200 feet wide at the base. Construction of the coffer dam could require placement of fill in the reservoir. It would extend from the left abutment to the existing dam, about 500 to 600 feet long. This temporary dam would be sized to allow the reservoir to store up to 30,000 acre-feet of water (45 percent of full pool). A dewatering system would also be required to remove seepage flows from the construction area. A second upstream coffer dam would be required around the inlet of the low level outlet works to allow dewatering of that structure during rehabilitation. This coffer dam could be constructed of earth fill or steel sheet piling, or a combination of both.

A downstream coffer dam would be placed just beyond the proposed stilling basin to allow diversion of streamflows around stilling basin construction. This dam would be relatively small, measuring about 10 feet high and 100 feet across.

2.3.1.3 County Road Improvements

About 8.5 miles of Big Horn County Road No. 380, leading to the dam site from Secondary Highway 314, would receive gravel surfacing and portions would be realigned (see **Figure 2-3**). An additional mile of this road would be rerouted west of the existing road to avoid the proposed construction staging area. This road may be improved so that it would permanently replace the current section of county road. Approximately 1.5 miles of county road in the construction area would be closed to public access during the period of construction to provide public safety and access for construction crews/vehicles. Construction gates would be installed at both ends of the closed portion of county road to prevent unauthorized access. Relocating the county road would require right-of-way easements from two private landowners.

Road improvements would be constructed during the period from spring through fall of 1996. During construction, traffic would be restricted, rerouted, and/or delayed during certain periods. Construction activities would require extensive use of this road for crews traveling to and from the site, and for heavy truckloads of materials such as reinforcing steel, cement, and concrete aggregate. The increased reservoir elevation would require realignment and improvements to the county road. Construction methods would include clearing of the new roadway alignment and cut-and-fill construction of the roadway section. A typical roadway cross section is shown in **Figure 2-6**. The county road improvements most likely would be conducted under a separate contract.

Traffic during construction would be safely controlled by flag persons and signs, appropriate to day, night, and climatic conditions. During construction, the contractor would be responsible for dust control using watering trucks and/or calcium chloride, and for periodically grading the road.

2.3.1.4 Structure and Shore Erosion Protection

With the 4-foot increase in reservoir elevation, subsequent floods would increase shore erosion along approximately 2.25 miles of Secondary Highway 314 embankment, Decker Coal's embankments and facilities, and bridges and culverts in the upper reservoir area. Protecting these facilities would require the use of dumped riprap or vegetation up to a proposed maximum elevation of 3,432.0 feet.

2.3.1.5 New Bridge Access

A bridge for pedestrians and vehicles would be provided for access to the gate house during flood events and for public access to lands on the east side of the dam after construction (see **Figure 2-7**). Final design would determine the specifications of both the bridge and the road leading to and from it.

2.3.1.6 Construction Staging Area

The construction staging area may impact up to 36 acres as shown on **Figure 2-7**. It would be designed by DNRC and the construction contractor in detail after final design since the precise size and location of buildings, trailers, batch plants, mills, and other temporary facilities will not be known until a preferred alternative is selected and a construction contractor hired. Site plans would emphasize ease of ingress and egress.

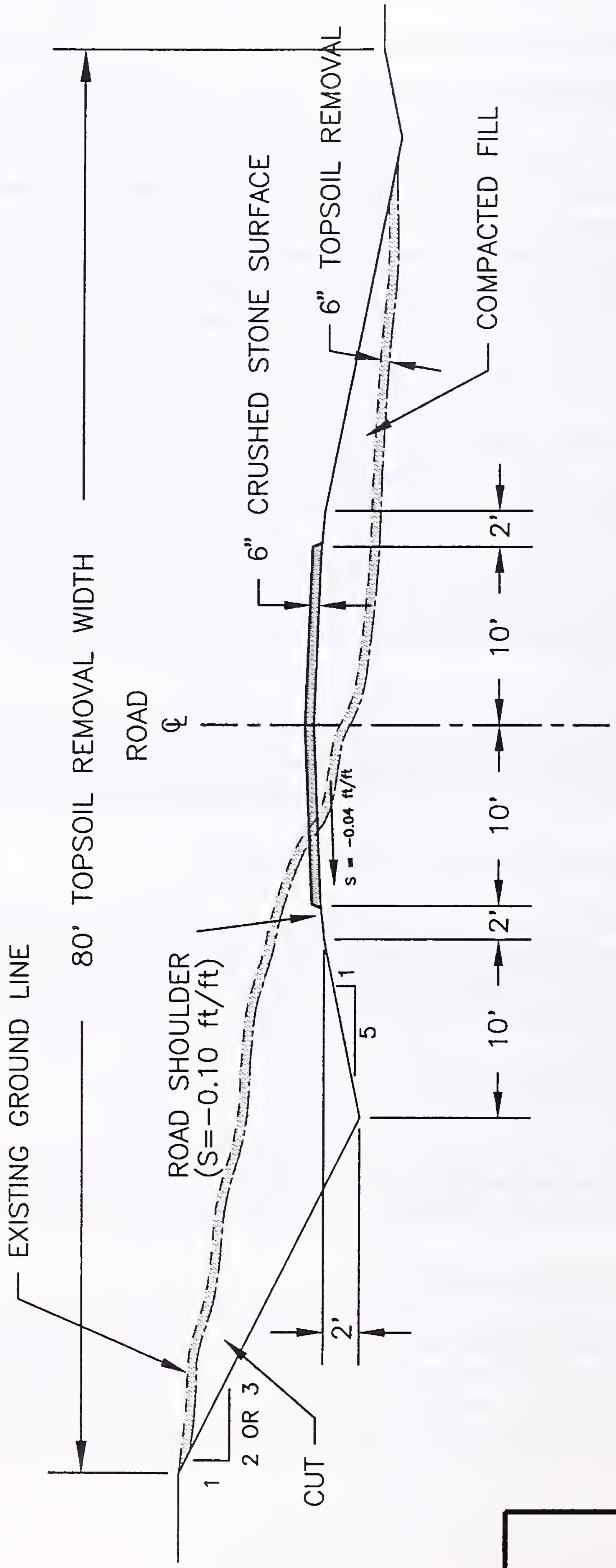


FIGURE 2-6

TYPICAL COUNTY ROAD CROSS SECTION

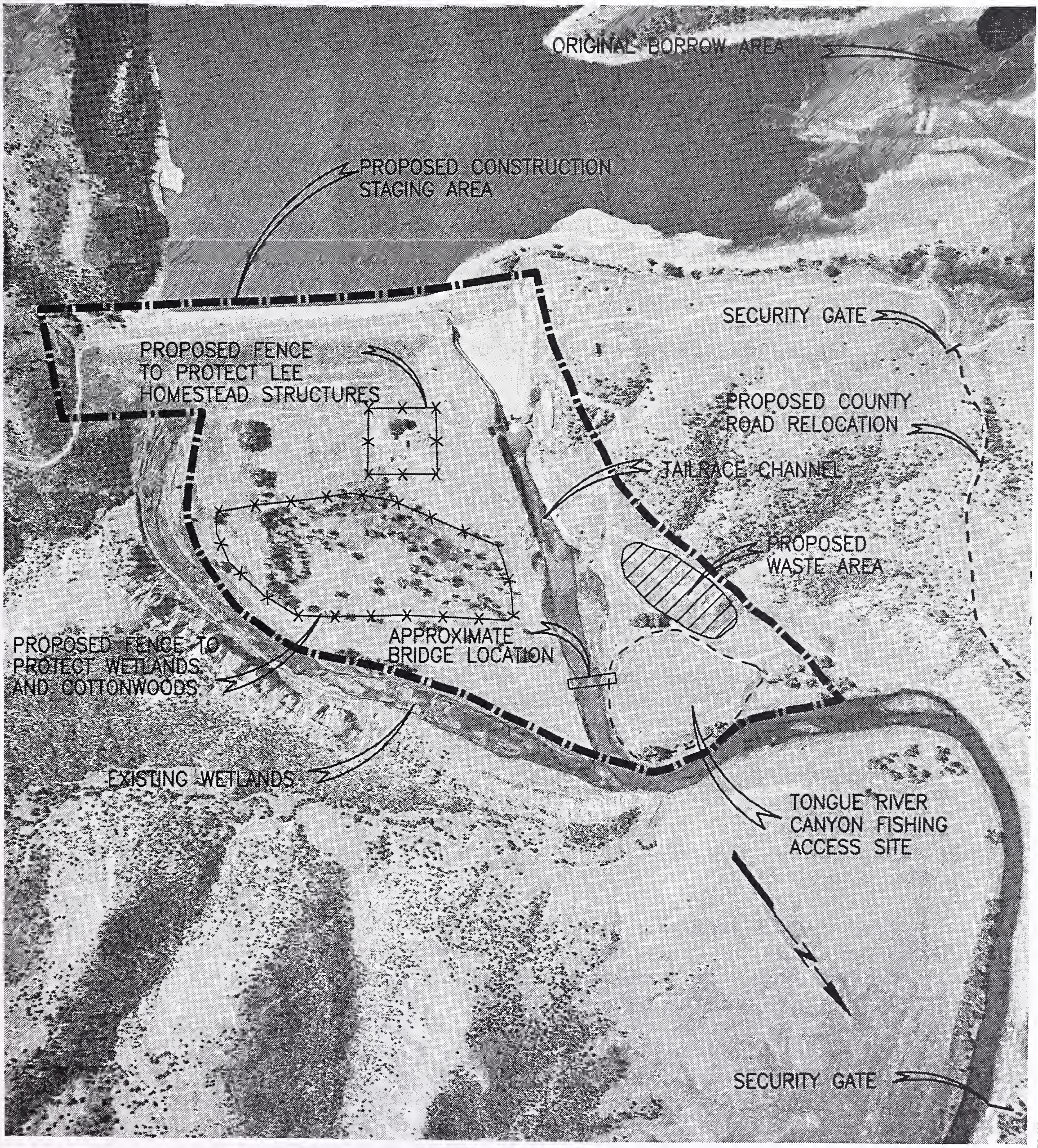


FIGURE 2–7

STAGING AREA PLAN

The construction staging area would include both the stream valley immediately below the dam and the Tongue River Canyon Fishing Access Site, located immediately downstream of the dam on the west side of the river. It would also include the waste area from original dam construction and add considerably to its current size.

During construction, the fishing access site would be closed. Public access to the site would be controlled by a security gate and rerouting of the existing county road as shown on **Figure 2-7**. Improvements would be required to bring this road to county standards.

The fishing access site would provide parking for construction personnel. Access for private cabin owners on the east side of the reservoir who normally use the dam crest would not be provided during construction.

Fueling and maintenance facilities would be located on a bench to provide sufficient separation between fuel tanks and ground water to meet applicable regulations. Fuel storage area(s) would be lined and bermed to provide protection against accidental spills reaching the river. The containment area would be excavated or bermed, impermeably lined, and able to contain 110 percent of the fuel tank(s) volume. A continuous leak-detection system would also be required. All refueling would be carried out on an impermeable refueling pad designed to contain any spills or overfills. A spill contingency plan would be prepared along with final design of the staging area.

A structural concrete batch (mixing) plant would be located at the staging area shown in **Figure 2-7**. This operation would produce some dust which would be controlled by watering. The river, or dewatering operations, would serve as the water source. A second continuous concrete batch plant such as a pug mill would be located at the staging area shown in **Figure 2-7** to mix the RCC. This operation would likely produce some dust which would be controlled by sprinkling with water from the river or dewatering operations.

Waste materials from construction (spoil) would be disposed of in a waste area used during the original construction and shown on **Figure 2-7**. Demolition of the existing spillway would require disposal of approximately 6,200 cubic yards of reinforced concrete materials. Reinforced concrete materials would be buried for safety.

The area design would include a runon-runoff protection plan to ensure contaminants are not delivered to drainages and, ultimately, the Tongue River. It would also include a plan for required utility upgrades for the site. Areas under and adjacent to fuel tanks and stockpiles of concrete materials would be lined and bermed to prevent the release of contaminants, and vehicle parking and maintenance areas would be designed to prevent oils, fuel, and other contaminants from impacting soils, surface water, or ground water. Lined settling ponds would collect process and runoff water from the facility. While a final water acquisition, use, and waste water disposal plan would be developed during final design, water is intended to be pumped from the Tongue River for use in operations, facilities, washing, and dust control. Gray and black water collected from washrooms and toilets would be collected and disposed of off site by a licensed operator. Water collected in settling ponds would be disposed of on site after testing established the acceptable quality of the water. A plan for fencing off the historic Lee Homestead structures would be an important aspect of area construction

and operations planning. Efforts (e.g., fencing) also would be undertaken to preserve as many mature cottonwoods in the staging area as is possible.

2.3.1.7 Railroad Unloading Facilities

It is planned that a rail car load-out site of about 5 acres would be associated with this project in the Sheridan, Wyoming area for offloading of riprap. The site may require the construction of a temporary load-out and attendant parking and turnaround areas for heavy equipment. It may also require adequate area for a materials stockpile and an excavator to remove materials from the gondola rail cars.

2.3.2 Material Requirements

2.3.2.1 Labyrinth Weir Spillway

Aggregate and Cement. Approximately 30,600 cubic yards of aggregate and 8,000 tons of cement would be required for structural concrete used in construction at the left abutment for the labyrinth weir spillway. Aggregate would be provided from a local source, Site No. 1 **(see Figure 2-3)**.

This site has been identified by DNRC as the source of aggregate for road improvement, structural concrete and RCC. Preliminary investigations by DNRC indicate that aggregate of sufficient quantity and quality exists at the site. The site would be operated through spring and summer of 1996 when road improvements were being made and aggregate was being developed and stockpiled for the labyrinth weir. The site would have both crushing and screening operations. The site may require utility service upgrading for planned operations. The detailed site plan developed during final design would have runon-runoff protection and a settling pond designed to collect runoff from the site. The detailed water acquisition, use, and waste water disposal plan would intend to acquire water from the reservoir for operations. Water collected in the settling pond could be disposed of on site if testing established the acceptable quality of the water. Gray and black water collected from washrooms and toilets would be collected and disposed of off site by a licensed operator. A licensed operator would collect all waste water and dispose of it at a licensed location.

Development of Site No. 1 would require an agreement with the respective landowner and the necessary open cut mining permit from Department of State Lands. The site would be drilled and sampled to verify the amount of aggregate available and its characteristics prior to final design. No mining would be allowed until a reclamation contract was entered into with the Board of Land Commissioners.

Processing aggregate would require the use of a crusher and screening operation to provide the angularity and size distribution required. The crusher operation would produce dust which would be controlled by bag filtration. A washing operation also would be required to clean the structural concrete aggregate to remove any fines. The washing operation would require a water source and a settling pond to trap the fine sediments. Process water would be disposed of by sprinkler irrigation or percolation. Aggregate materials would be stockpiled both at Site No.1 and at the staging area for later use.

Reinforcing Steel. About 2,300 tons of reinforcing steel would be stockpiled on site.

RCC Aggregate and Cement. Approximately 61,000 cubic yards of aggregate would be required from Site No. 1 to construct the RCC foundation for the Labyrinth Weir Spillway. There is potential for aggregate to be used from the north portion of Site No. 2 because it may be more cost-effective. However, it may be disruptive to the construction staging area. If exploration of Site No. 2 revealed suitable quality and quantity of aggregate and disruption could be minimized, then the quantity of aggregate taken from Site No. 1 would be reduced. (For a full discussion of Site No. 2, see Alternative 2 construction staging area discussion.) About 7,400 tons of cement would also be required.

2.3.2.2 Low Level Outlet Works

Construction components of the new auxiliary and primary low level outlet works would include new operating gates, new emergency gates, and new hydraulic gate operators.

Aggregate and Cement. About 1,320 cubic yards of aggregate would be used in construction of the auxiliary and primary low level outlet works and 515 tons of cement would be required.

Reinforcing Steel. About 137 tons of reinforcing steel would be hauled in and stockpiled at the staging area.

2.3.2.3 Coffer Dams

Earth Fill. Construction of the upper and lower coffer dams would require 23,000 and 5,600 cubic yards of material, respectively. This material would come from the spillway excavations, Site No. 2, or the original borrow area located in the reservoir (see **Figure 2-7**).

2.3.2.4 County Road Improvements

Aggregate. Surfacing improvements to 9.5 miles (8.5 miles on existing County Road No. 380 and 1 mile on relocated alignment) of County Road No. 380 would require approximately 19,000 cubic yards of gravel aggregate from Site No. 1.

2.3.2.5 Structure and Shore Erosion Protection

Riprap. No known quarries producing riprap have been identified adjacent to Tongue River Reservoir. About 91,000 cubic yards of riprap could be needed for structure and shore erosion protection. About 69,000 cubic yards of dumped riprap materials would be required to protect the Highway 314 embankment, and 22,000 cubic yards would be required to protect Decker Coal mine facilities and bridges and culverts in the upper reservoir area. A 30-inch-thick layer of dumped riprap materials would be provided with an average diameter of 15 inches. The amount of dumped riprap required for road protection could be reduced during final design if methods of erosion protection using vegetation were found to be suitable. If sufficient quantity and quality of riprap was found during excavation of the existing spillway or in the local area, the amount of imported riprap would be reduced.

The dumped riprap would be placed on the prepared embankment by shaping the existing embankment from elevation 3,432 feet downward to a point below elevation 3,428.4 feet. A filter fabric would be placed

underneath the dumped riprap materials to prevent piping of fine materials through the dumped riprap layer. Site preparation and placement of riprap would take place when the reservoir was drawn down, to avoid water quality impacts.

2.3.3 Material Hauling

The staging of materials hauling in terms of time-of-year, truck numbers and sequencing and safety considerations would be developed during final design. Actual construction sequencing requirements, available staging area and materials production capacity may limit the number of trucks and trip frequency which would extend the number of days required to move the necessary tonnage.

Mixed structural concrete would be transported from the batch plant to the spillway construction site on short temporary haul roads by concrete mix trucks, pumps, or a system of conveyors. If conveyors were used, they would run from the construction staging area to the spillway.

Approximately 1,185 trips would be made to and from the staging area via County Road No. 380, Secondary Highway 314, Secondary Highway 338 and, possibly, Interstate Highway 90 for other construction materials such as reinforcing steel and cement.

The 1,185 trips made to deliver other construction materials could be staged strategically over the four-to-five-month period prior to and including preconstruction project activities such as mobilization and demolition. While a larger network of highways would be impacted by the construction material hauling, the delivery schedules would be planned during final design in a manner to minimize impacts on traffic.

2.3.3.1 Labyrinth Weir Spillway

Disposal of the existing spillway materials and excess excavation required to construct the spillway would require use of conveyor equipment, or about 33,000 round trips between the spillway excavation and the waste area using equipment with a 20-cubic-yard capacity.

Aggregate from Site No. 1 would be hauled to the construction staging area on County Road No. 380. Assuming 20 cubic yards per trip, approximately 1,530 trips would be required to transport the aggregate materials from Site No. 1 to the staging area.

Approximately 800 trips would be required to transport the cement material to the job site. These trips would require the use of County Road No. 380, Secondary Highway 314, Secondary Highway 338, and perhaps Interstate Highway 90.

Reinforcing steel would have to be hauled to the construction staging area using the same network of roads as for cement hauling. Assuming 15 ton loads per trip, approximately 115 trips would be required to transport the reinforcing materials to the staging area.

2.3.3.2 RCC Foundation

RCC aggregate would be hauled from Site No. 1 to the construction staging area on County Road No. 380. Assuming 20 cubic yards per trip, approximately 3,050 trips would be required to transport the aggregate materials from Site No. 1 to the staging area. If aggregate was obtained from Site No. 2, truck trips would be reduced on the county road.

Approximately 270 trips would be required to transport the cement materials to the staging area site. These trips would require the use of County Road No. 380, Secondary Highway 314, Secondary Highway 338, and possibly Interstate Highway 90. The materials would be stockpiled on site. The staging and stockpile areas would require reclamation.

Mixed RCC would be transported from the batch plant to the spillway construction site on short, temporary haul roads by trucks or heavy equipment, pumps, or a system of conveyors. Assuming 20 cubic yards per trip, about 3,050 truck trips would be required.

2.3.3.3 Low Level Outlet Works

About 220 truckloads of mixed concrete would be transported from the staging area to the outlet works sites by trucks and pumps for the low level outlet works.

2.3.3.4 County Road Improvements

Gravel from Site No. 1 would be hauled and used for graveling of County Road No. 380. Assuming 20 cubic yards per trip, approximately 950 trips would be required to transport the gravel.

2.3.3.5 Structure and Shore Erosion Protection

It is assumed that riprap would be brought in by rail to the Sheridan, Wyoming area from a source in eastern Wyoming, or that a source of local riprap would be located near Sheridan and trucked in. If rail was used, approximately 1,800 railroad carloads would be required to transport 91,000 cubic yards of riprap. The riprap would then be placed in trucks for transportation to each bank/structure erosion protection site.

Approximately 9,100 truckloads at 10 cubic yards per load would be required to transport the riprap to each job site from either a local source or the rail yard. The load maximum is based on highway load restrictions. Transport would likely take place via Interstate 90, Secondary Highway 338, Secondary Highway 314, county roads, mine roads, and undeveloped roads to each site.

2.3.4 Major Construction Activities

2.3.4.1 Reservoir Drawdown and Downstream Releases During Construction

Alternative 1 would require reservoir drawdown for three activities:

- construction of the labyrinth weir spillway foundation;
- construction of the auxiliary low level outlet works; and
- construction of modifications to the existing low level outlet works.

Construction of the coffer dams would require the reservoir to be drawn down to elevation 3,390.5 feet (9,000 acre-feet of storage) over a 1-to-2-month period during spring of 1997. A minimum upstream coffer dam elevation of 3,426 feet would provide protection from up to a 25-year flood and related overtopping.

The reservoir pool would be held at elevation 3,390.5 feet for several weeks to allow for the construction of the upstream coffer dam. Upon completion of the upstream coffer dam, the reservoir would be filled from spring runoff to elevation 3,409 feet (30,000 acre-feet of storage). The reservoir would then be drawn down to elevation 3,390.5 feet to meet summer irrigation deliveries. The intake structure for auxiliary low level outlet works would be constructed during the fall of 1997. Placement of the new gates in the primary low level outlet gate tower and construction of the new downstream conduit would immediately follow.

The reservoir would then be allowed to refill to elevation 3,409 feet (30,000 acre-feet) during the spring of 1998. This water would be used to meet releases for contract water users during the summer of 1998. Construction of the labyrinth weir spillway would continue through the summer and fall of 1998. Upon completion of the spillway, the reservoir would be allowed to refill to the new spillway crest elevation of 3,428.4 (80,000 acre-feet of storage) feet during the 1999 runoff season.

During the construction period, a target release of 190 cfs with an allowable one-time short-term (2 weeks) release of not less than 25 cfs would be maintained through the low level outlet works and the temporary bypass to reduce impacts to aquatic life and fisheries. This minimum, provided via pumping during installation of the bypass, would be used only during times of the year when icing and heat-load conditions were acceptable (fall and spring). Delivery of water to contract water users could be interrupted or reduced during the summers of 1997 and 1998.

Preliminary analysis by DNRC indicates that the project may be able to store up to 30,000 acre-feet of contract water during construction. The amount stored would depend on the alternative selected, the actual construction schedule, and the risk of acceptable flooding during construction as determined by DNRC. Water stored during construction would be captured at the end of the runoff season and released for irrigation (July to August).

2.3.5 <u>Overall Construction Schedule</u>

2.3.5.1 Description of Construction Steps

The sequence of construction activities is shown in **Figure 2-8**. Estimated time requirements and scheduling of each construction activity are shown in **Figure 2-9**.

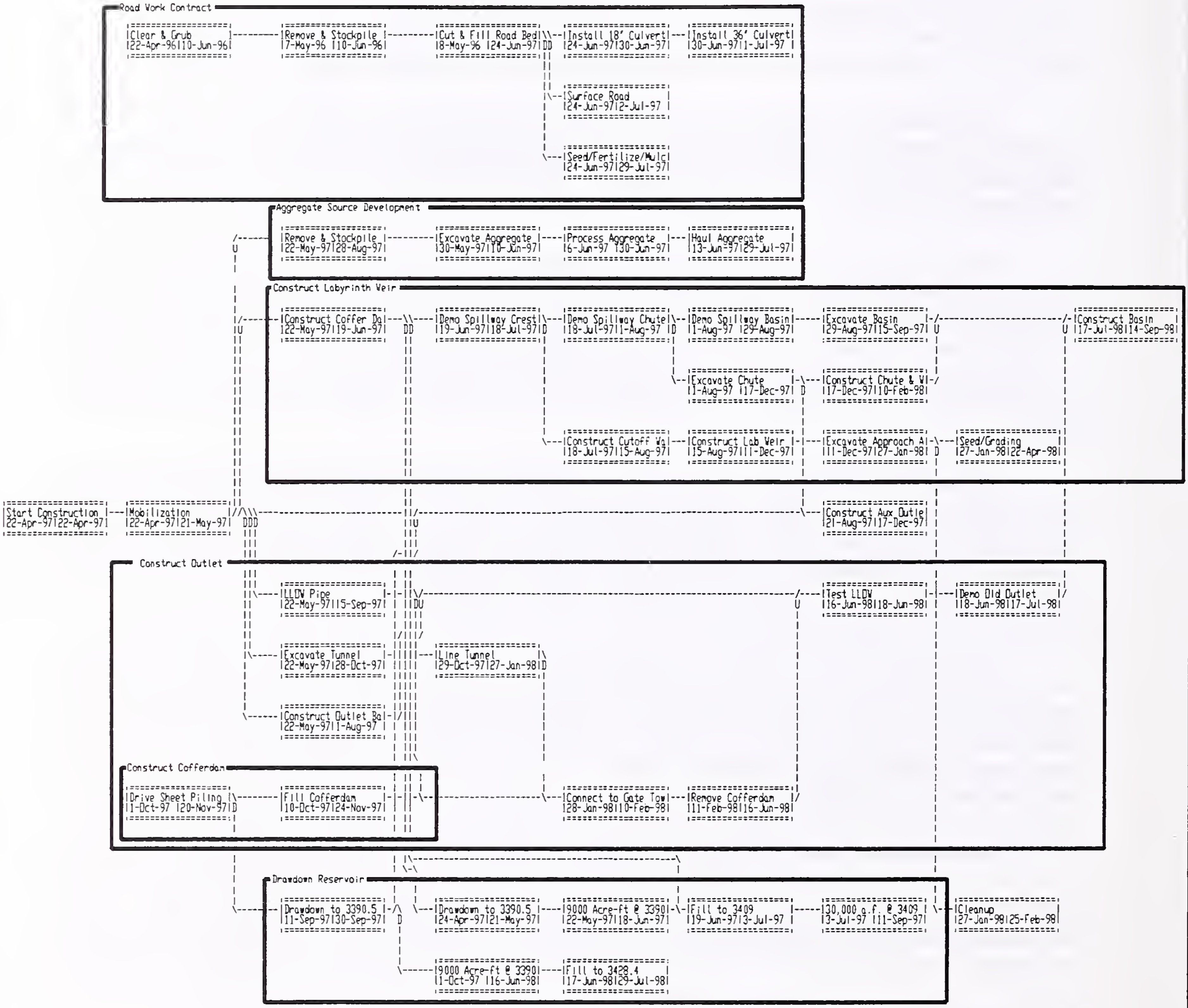
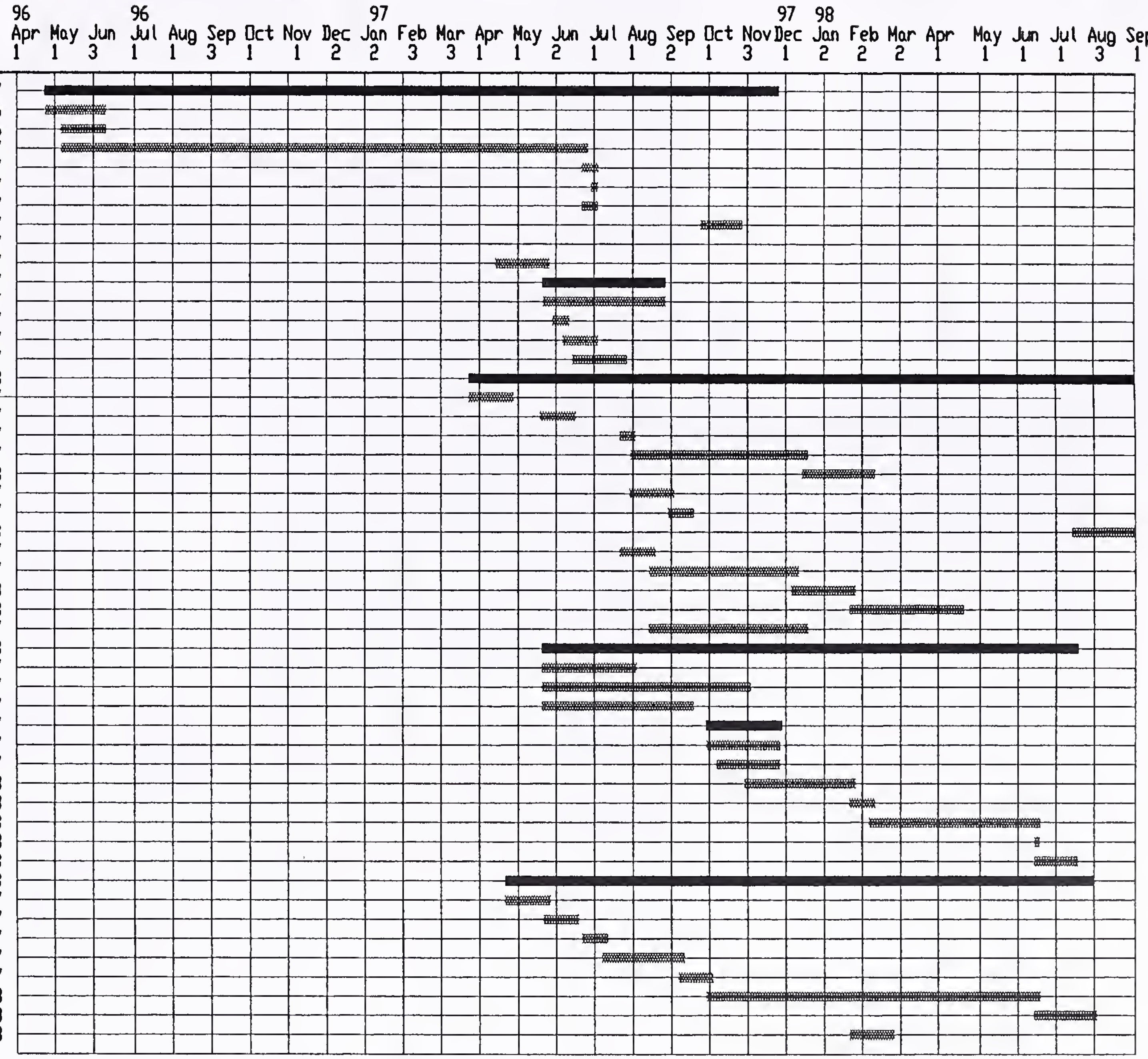


FIGURE 2–8

PROJECT FLOW CHART FOR LABYRINTH WEIR

Task Name	Start Date	Duration	End Date
Road Work Contract	22-Apr-96	64.2 w	29-Oct-97
Clear & Grub	22-Apr-96	34.6 d	10-Jun-96
Remove & Stockpile T	7-May-96	23.1 d	10-Jun-96
Cut & Fill Road Bed	8-May-96	285.0 d	24-Jun-97
Install 18' Culverts	24-Jun-97	4.1 d	30-Jun-97
Install 36' Culverts	30-Jun-97	0.9 d	1-Jul-97
Surface Road	24-Jun-97	5.6 d	2-Jul-97
Seed/Fertilize/Mulch	24-Sep-97	23.6 d	29-Oct-97
*Start Construction	22-Apr-97	0.0	22-Apr-97
Mobilization	22-Apr-97	22.0 d	21-May-97
Aggregate Source Develo	22-May-97	13.8 w	28-Aug-97
Remove & Stockpile T	22-May-97	68.9 d	28-Aug-97
Excavate Aggregate	30-May-97	7.1 d	10-Jun-97
Process Aggregate	6-Jun-97	16.6 d	30-Jun-97
Haul Aggregate	13-Jun-97	31.3 d	29-Jul-97
Construct Labyrinth Wei	22-Mar-97	329.3 d	14-Sep-98
Construct Coffer Dam	22-Mar-97	19.1 d	19-Apr-97
Demo Spillway Crest	19-Jun-97	20.0 d	18-Jul-97
Demo Spillway Chute	18-Jul-97	10.0 d	1-Aug-97
Excavate Chute	1-Aug-97	94.0 d	17-Dec-97
Construct Chute & Wa	17-Dec-97	36.0 d	10-Feb-98
Demo Spillway Basin	1-Aug-97	20.0 d	29-Aug-97
Excavate Basin	29-Aug-97	10.0 d	15-Sep-97
Construct Basin	17-Jul-98	40.0 d	14-Sep-98
Construct Cutoff Wal	18-Jul-97	20.0 d	15-Aug-97
Construct Lab Weir &	15-Aug-97	80.0 d	11-Dec-97
Excavate Approach Ar	11-Dec-97	30.0 d	27-Jan-98
Seed/Grading	27-Jan-98	60.0 d	22-Apr-98
Construct Aux Outlet	21-Aug-97	80.0 d	17-Dec-97
Construct Outlet	22-May-97	289.3 d	17-Jul-98
Construct Outlet Bas	22-May-97	50.0 d	1-Aug-97
Excavate Tunnel	22-May-97	110.0 d	28-Oct-97
LLOW Pipe	22-May-97	80.0 d	15-Sep-97
Construct Cofferdam	1-Oct-97	36.1 d	24-Nov-97
Drive Sheet Pilin	1-Oct-97	35.0 d	20-Nov-97
Fill Cofferdam	10-Oct-97	29.1 d	24-Nov-97
Line Tunnel	29-Oct-97	60.0 d	27-Jan-98
Connect to Gate Towe	28-Jan-98	10.0 d	10-Feb-98
Remove Cofferdam	11-Feb-98	87.2 d	16-Jun-98
Test LLOW	16-Jun-98	2.0 d	18-Jun-98
Demo Old Outlet	18-Jun-98	20.0 d	17-Jul-98
Drawdown Reservoir	24-Apr-97	318.0 d	29-Jul-98
Drawdown to 3390.5	24-Apr-97	20.0 d	21-May-97
9000 Acre-ft @ 3390.	22-May-97	19.0 d	18-Jun-97
Fill to 3409	19-Jun-97	10.0 d	3-Jul-97
30,000 a.f. @ 3409	3-Jul-97	48.0 d	11-Sep-97
Drawdown to 3390.5	11-Sep-97	14.0 d	30-Sep-97
9000 Acre-ft @ 3390.	1-Oct-97	177.0 d	16-Jun-98
Fill to 3428.4	17-Jun-98	30.0 d	29-Jul-98
Cleanup	27-Jan-98	4.0 w	25-Feb-98



Sub Task
Major Task
* Milestone

FIGURE 2-9

PROJECT TIMELINE
FOR LABYRINTH WEIR

2.3.5.2 Employment Requirements

Preconstruction Employment. The estimated employment requirements during preconstruction are shown on **Table 2-1.** **Figure 2-10** displays employment scheduling. Labor would be required for road improvement activity preceding construction; aggregate extraction, crushing, screening and washing operations; riprap hauling and placement; and aggregate hauling.

TABLE 2-1
Estimated Preconstruction Employment

TASK	SKILLED LABOR BY TASK AND CREW SIZE	SEMI-SKILLED LABOR BY TASK AND CREW SIZE	TOTAL EMPLOYMENT
Aggregate development	4	1	5
County road improvements	5	2	7
Riprap erosion protection	15	7	22
TOTAL	24	10	34

Construction Employment. Estimated employment required for construction activities is shown on **Table 2-2.** **Figure 2-11** displays employment scheduling. A primary contractor would be hired to construct repairs to the dam. It is assumed that 25 percent of the total work force associated with construction would be brought in by the contractor for administrative, supervisory, and key operator positions. A target of 75 percent of the total labor positions estimated for all construction and related activities would be occupied by local members of the Northern Cheyenne Tribe (see Chapter 3, Socioeconomics). These laborers would travel daily to and from the work site to centers such as Ashland, Birney Village, Lame Deer and Busby. Other laborers would likely travel from Billings, Montana and Sheridan, Wyoming or outlying areas. Tribal members could also camp on their newly acquired land near Tongue River Reservoir.

TABLE 2-2
Estimated Employment During Construction for Alternative 1

TASK	SKILLED LABOR BY TASK AND CREW SIZE	SEMI-SKILLED LABOR BY TASK AND CREW SIZE	TOTAL EMPLOYMENT
Site work and reclamation	1	1	2
Low level outlet works	11	6	17
Labyrinth spillway structural concrete	5	2	7
TOTAL	17	9	26

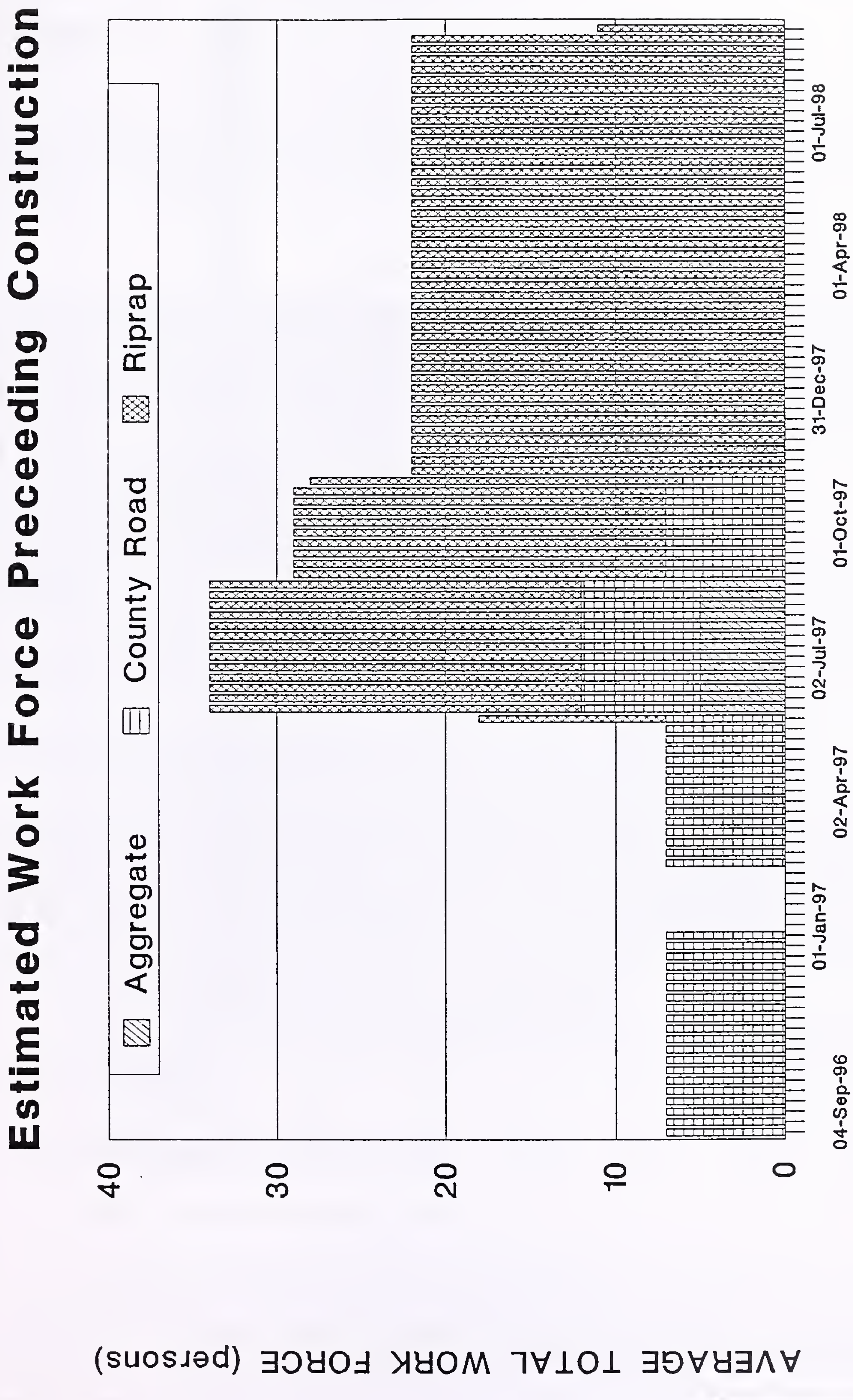


FIGURE 2–10

PRECONSTRUCTION EMPLOYMENT SCHEDULING

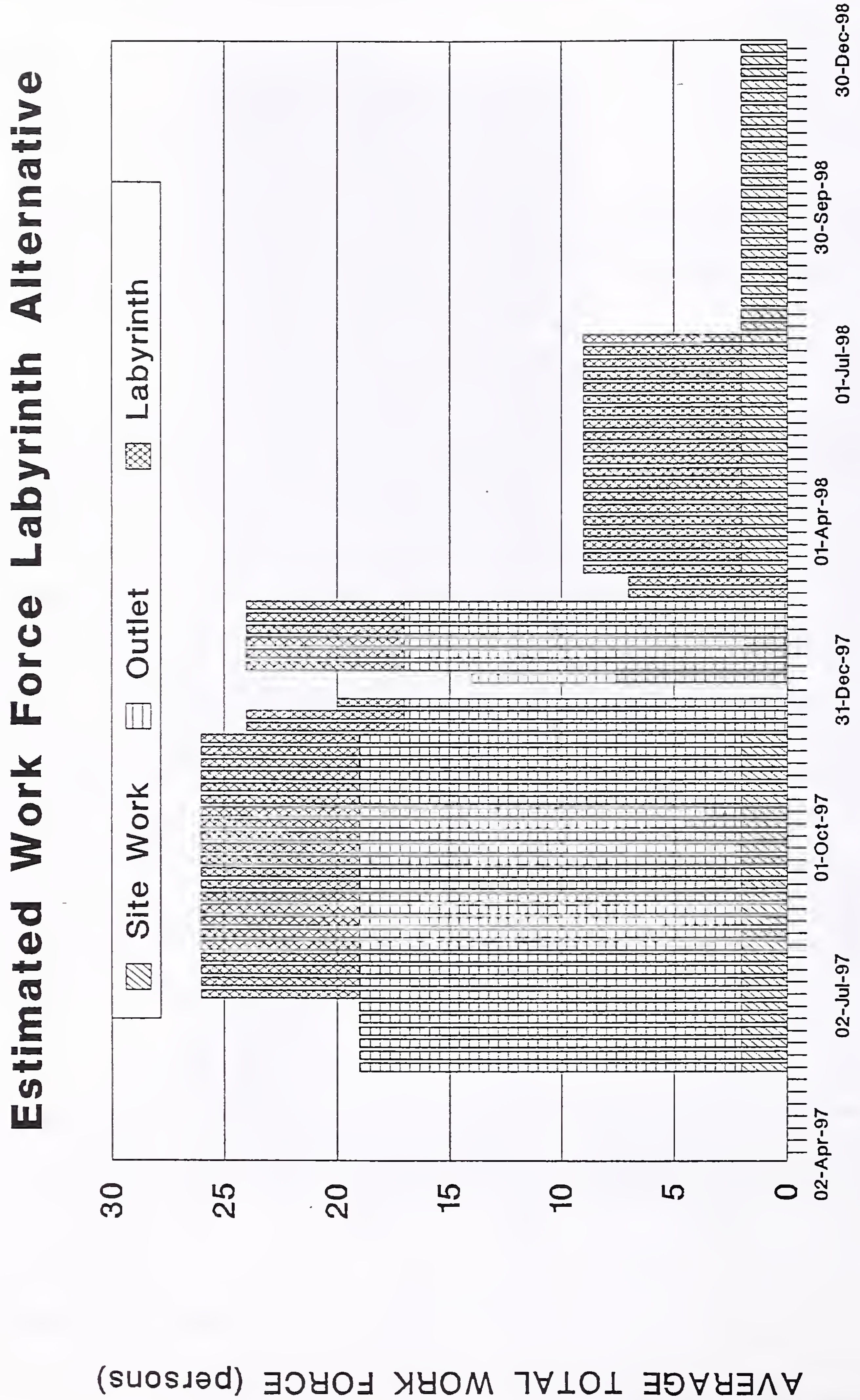


FIGURE 2-11

LABYRINTH WEIR
EMPLOYMENT SCHEDULING

Mitigation Employment. Employment required for mitigations would be associated with the tasks listed in **Table 2-3.** A target of 75 percent of the total labor positions estimated for all mitigation and enhancement activities would be occupied by local members of the Northern Cheyenne Tribe.

TABLE 2-3
Estimated Employment for Mitigation[1]

TASK	SKILLED EMPLOYMENT BY TASK AND CREW SIZE	SEMI-SKILLED EMPLOYMENT BY TASK AND CREW SIZE	TOTAL EMPLOYMENT
Coal mine	•	•	3
Riparian planting, constructing wetlands	1	•	6
Livestock exclusion fencing	0	2-3	2-3
State park improvements	2	2	4
TOTAL	**4**	**11-12**	**15-16**

Note: [1] Employment estimates for enhancement are not included in these employment figures since specific projects and employee requirements are unknown at this time.

2.3.6 Probable Construction Cost Estimate

The probable construction cost estimate for Alternative 1 is shown in **Table 2-4** and equals $26,928,825 for the dam safety improvements. This cost does not include construction activities associated with the overall project such as the county road improvements, structure and shore erosion protection, mitigation, and enhancement. Including other construction-related costs, the cost estimated for this project is $37-40 million.

2.3.7 Land Disturbance

Up to 157 acres would be disturbed if Alternative 1 was implemented including 60 acres for aggregate mining, 56 acres for county and campground roads, 5 acres for rail load-out at Sheridan, and up to 36 acres for the construction staging areas.

2.3.8 Facility Monitoring and Reclamation

2.3.8.1 Construction Staging Area

The construction staging area would be used for a period of 18 to 24 months between 1996 and 1998. The area would have to be constructed in accordance with approved facility site preparation, operation, and reclamation plans developed during final design of the site. The wetland adjacent to the proposed staging area would be accounted for, avoided if possible, and/or mitigated as part of the overall habitat mitigation plan. Plans would be developed in consultation with the construction contractor to monitor and/or prevent any

TABLE 2-4
Probable Construction Cost Estimate for Labyrinth Weir Spillway

DESCRIPTION	QUANTITY	UNIT	UNIT $	AMOUNT
Mobilization & Prep		LS		$1,165,750
Demo Spillway	6,200	cy	80	496,000
Excavation-50% Rock	660,000	cy	5	3,300,000
Backfill	140,000	cy	3	420,000
Compacted Fill	35,000	cy	6	210,000
Riprap	3,000	cy	30	90,000
Bedding	1,000	cy	30	30,000
Anchor Bars	84,500	lf	10	845,000
8" SP Drain Pipe	6,800	lf	20	136,000
Weir Floor Concrete	6,800	cy	220	1,496,000
Weir Wall Concrete	5,300	cy	250	1,325,000
Chute Floor Concrete	9,500	cy	220	2,090,000
Chute Wall Concrete	1,400	cy	250	350,000
Basin Floor Concrete	6,200	cy	220	1,364,000
Basin Wall Concrete	1,400	cy	250	350,000
RCC	61,000	cy	45	2,745,000
Cutoff Wall Concrete		LS		270,000
Cement	15,400	tons	90	1,386,000
Reinforcement	2,300	tons	1,000	2,300,000
Upstream Coffer Dam	23,000	cy	8	184,000
Downstream Coffer Dam	5,600	cy	5	28,000
River Diversion		LS		150,000
Dewatering		LS		250,000
New Outlet Works	1	LS		3,500,000
Subtotal				24,480,750
10% Contingency				2,448,075
TOTAL				$26,928,825

Note: LS=lump sum, cy=cubic yards, lf=lineal feet

damage to cottonwood trees in the area. Roads, vehicle parking, and equipment operation and storage would be designed to prevent oils, fuel and other contaminants from impacting soils, surface or ground water. Lined settling ponds would collect process and runoff water from the facilities. Contingency plans for protection of ground and surface water targeting equipment maintenance, fuel, and other hazardous materials would be developed to ensure contaminants were not delivered to the Tongue River.

The performance of water quality protection features at the staging area and other construction operation sites would be monitored during the 18 to 24 months of operation. Necessary repairs and adjustments would be made immediately with curtailment of relevant operations, as required. Weekly inspections of leak containment systems, runon/runoff protection systems, gray and black water containment systems, and process runoff collection systems would be conducted along with continuous monitoring of a possible dust reduction system relative to crushing and screening operations. Settling pond maintenance would be conducted as necessary to maintain design capacity requirements.

Air quality impact abatement measures would be required for continuous dumping and wind erosion associated with the waste dump area, transport of materials between sites, lack of intermediate cover at the waste pile, and exposed soil and materials stockpiles. Air quality monitoring could be required at the construction staging area if crushing and screening operations used aggregate from Site No. 2 (see discussion under Construction Staging Area and Alternative 2).

The staging area would be reclaimed following construction. Recontouring to preoperation contours, cleanup of debris and hazardous materials, scarifying of roadways and compacted areas, and reseeding to establish natural vegetation would be incorporated into reclamation plans. The proposed fuel and repair area would be revegetated after first removing or treating any contaminated soils.

Reclamation plans for the remainder of the project would be developed during final design that reflected the requirements of all permit and relevant environmental regulations. Recontouring to preoperation contours, scarifying roads and compacted areas for seedbed preparation, reseeding with a prescribed vegetative mix, and cleanup of debris and other project generated materials would be conducted. Containment systems for storm and process water would be removed, with liners and impacted materials appropriately disposed of off site. Settling ponds would be excavated, liners would be removed, sites would be restored to pre-project contours and reseeded, if appropriate.

Fueling Facilities. After project completion, the impermeable refueling pad, containment area, and tanks would be removed and reclaimed. The area would be recontoured (if necessary), and soils prepared for reseeding in native grasses. Any contaminated soils would be disposed of in accordance with approved reclamation plans that reflected the requirements of all permits and relevant environmental regulations.

Fishing Access Site. The current fishing access site, proposed as a parking area during construction, would be reclaimed and restored to its existing configuration.

Waste Disposal Area. At project completion, the rectangular-shaped waste pile is projected to contain up to 500,000 cubic yards of additional materials and would encompass about 7 acres and be up to 50 feet high. The pile would be located at the base of the hills on the west side of the river. Reclamation would include recontouring so that its profile appeared to be an extension of the adjacent slope. Reclamation of the

area would be carried out in accordance with an approved reclamation plan that reflected the requirements of all permits and relevant environmental regulations. The detailed site plan for the waste area would propose the precise size, location, and final topographic configuration, cover, and runon/runoff protection for the area.

2.3.8.2 Aggregate Site No. 1

During road improvement and construction, this site would be monitored as to the performance of air and water quality protection features. Necessary repairs and adjustments would be made immediately with curtailment of relevant operations as required. Weekly inspections of runon and runoff protection systems, gray and black water containments systems, and process runoff collection systems would be conducted along with continuous monitoring of the dust reduction system. Settling pond maintenance would be conducted as necessary to maintain design capacity requirements.

Reclamation of aggregate Site No. 1 would be in accordance with a reclamation plan developed during final design that reflected requirements of all permits and relevant environmental regulations. Final topography would reflect the surrounding natural terrain.

2.3.8.3 Aggregate Site No. 2

See discussion under Alternative 2.

2.3.8.4 Haul Roads

County roads would remain in their improved and realigned condition. The short-haul road between Site No. 1 and the county road may remain in place.

2.3.8.5 Railroad Unloading Facilities

During construction, operations at these sites would be monitored for the performance of air and water quality protection features. Necessary repairs and adjustments would be made immediately with curtailment of relevant operations as required. Settling pond maintenance would be conducted as necessary to maintain design capacity requirements.

Portions of these sites have been disturbed previously. Reclamation would be appropriate to future plans for the site. Reclamation would be in accordance with a plan developed during final design that reflects requirements of all permits and relevant environmental regulations.

2.3.9 Proposed Mitigations and Monitoring

Mitigation plans have been prepared to address anticipated impacts from this project. All mitigations suggested below would be implemented under either of the action alternatives.

2.3.9.1 Public Safety Mitigation

An emergency mock evacuation drill for persons living in the Tongue River Basin below the dam may be held in fall 1996, prior to initiation of spillway construction. This drill may be coordinated by Disaster and Emergency Services.

2.3.9.2 Agricultural Mitigation

DNRC has prepared an agricultural mitigation plan entitled *Tongue River Basin Project Downstream Agricultural Mitigation Plan.* This plan is incorporated by reference into this draft EIS and is available on file at DNRC. The following steps, summarized from the mitigation plan, have been proposed by the project sponsors to mitigate potential downstream agricultural losses during construction:

1) At a minimum, to supply run-of-river releases (outflow from dam = inflow to reservoir) during the irrigation season. This would supply water to decreed water users that would normally be available without using water stored in the reservoir.

2) Monitor streamflows immediately downstream of the dam, at Birney Village, at Ashland, near the Brandenburg Bridge, at Miles City, and in the Tongue and Yellowstone (T&Y) canal downstream of the canal crossing of Pumpkin Creek. Water would be "tracked" (possibly by a temporary water commissioner) down the river to ensure that it reached the T&Y diversion. T&Y holds an early, large water right, the second decreed right on the river for 187.5 cfs. As a minimum, this would maintain the status quo (i.e., keep the stream flowing between the dam and the T&Y diversion). The Tongue River historically has been dewatered, or nearly so, below the T&Y diversion during the irrigation season.

3) Plan construction, assess the risk of storing water during construction, build coffer dams, and schedule drawdown with the objective of storing as much water as possible for delivery to water contract holders.

4) Potentially compensate agricultural producers for a portion of incurred losses. DNRC would determine the amount of water not delivered and compensate water contract holders at the effective average water contract price for documented losses that could be directly attributed to the construction project.

2.3.9.3 Wildlife Mitigation

USBR prepared a mitigation plan entitled *Tongue River Basin Project EIS Fish and Wildlife Habitat Mitigation Plan (1994).* This document is incorporated by reference into this draft EIS and is available on file at DNRC. A critical component of this plan involves an Interagency Mitigation and Enhancement Team (Team) consisting of representatives of the project sponsors, U.S. Fish and Wildlife Service (USFWS), the Montana Department of Fish, Wildlife and Parks (DFWP), and Bureau of Indian Affairs (BIA). The Team was chartered to identify and implement necessary and beneficial mitigation measures. The primary resource areas addressed by the Team included wildlife resources, aquatics and fisheries, additional habitat in the project area, and wetlands. Proposed mitigations for the resource areas are described below.

From USBR's mitigation plan, the project sponsors would implement the following wildlife mitigations:

1) Establish a wildlife management area encompassing 1,082 acres of suitable project lands and lands to be acquired for the mitigation of woody and herbaceous riparian wildlife habitat lost due to the project. The wildlife management area would be established by acquisition of land through fee title or easement and may be developed and managed in conjunction with the enhancement measures presented in Fish and Wildlife Habitat Enhancement Features.

2) The wildlife management area would also include about 328 acres of suitable grassland and scrub forest habitat within the expanded project takeline following spillway renovation.

3) Renovate and improve the Pike Pond waterfowl impoundment located in Section 15, T9S, R40E, (**see Figure 2-3**) in order to preserve its existing wetland character and values (6.5 acres). If it is eventually determined that it is impractical to preserve this wetland, the potential loss of wetland habitat would be mitigated by development of an equal amount of wetland.

2.3.9.4 Aquatics and Fisheries Mitigation

The plan also sets forth the following fisheries mitigation measures if determined to be necessary:

1) Initiate a supplemental walleye stocking program for Tongue River Reservoir following refilling, using 10,000 8-inch yearling fish annually, for a 2-year period. Costs are estimated to be $20,000 for the entire stocking program ($16,000 for the fish and $4,000 for transporting them from an available source).

2) Establish a program to monitor, and possibly restock, the spottail shiner population in Tongue River Reservoir. Monitoring would cost about $1,000, while restocking, if required, would cost about $4,000 over a 2-year period.

3) Establish a program to monitor and possibly restock smallmouth bass in the reach of Tongue River between the dam and Ashland. Monitoring would cost an estimated $3,600 while restocking, if required, would cost about $38,400. A one-time stocking of 128,000 2-inch fingerling smallmouth bass would be conducted.

4) Initiate a supplemental smallmouth bass and channel catfish stocking program in the reach of Tongue River between Ashland and the T & Y Diversion Dam (**see Figure 1-1**). The one-time introduction of 155,000 2-inch fingerling smallmouth bass and 77,500 2-inch fingerling channel catfish would be conducted after project construction and restoration of normal streamflows. Total cost is estimated at $52,000.

5) Provision would be made in a memorandum of agreement or other suitable instrument for mitigating the impacts of fishery resources of any unanticipated events, such as a drastic winter-kill during reservoir drawdown or an emergency or other short-term shutdown of

water releases at the dam during project reconstruction. Restocking, water pumping (to provide fish survival flows in the river), or other costs would be included among project costs for fishery mitigation.

6) To minimize impacts to downstream aquatics, DFWP would monitor the condition of the river downstream of the dam during construction of the project. A target release of 190 cfs would be maintained during the construction period with the exception of low flows during installation of the low level outlet works. A one-time low flow of no less than 25 cfs for no more than 2 weeks would be minimized and used only during times of the year when icing and high water temperatures would not stress aquatic biota (fall and spring). The minimum flow released would be increased to 75 cfs if icing and/or high water temperatures stressed aquatic biota. If excess streamflow allowed, releases beyond maintenance level would be made in mid-May to September to facilitate spawning runs of warm-water species and provide improved aquatic habitat.

7) Restock the rainbow trout population in the Tongue River downstream of the reservoir.

2.3.9.5 Additional Habitat Mitigation

Habitat would be affected by fluctuating reservoir water levels: low during construction and high following runoff. General measures that would be taken to protect habitat values include:

1) Reservoir levels would be maintained at the highest possible elevation at all times during the construction period. These levels would be governed by safe operating limits for the reservoir as well as water for contract holders and other needs described below.

2) To maintain in-stream flows during critical periods during construction, funds may be made available in the project budget to lease water from willing agricultural water users, provided the state has in place a monitoring and enforcement program to stop lower priority diversions.

3) To replace habitat lost to inundation, the project sponsors would conduct a planting program above the new high water mark in suitable areas to mimic or enhance existing riparian conditions to expedite re-establishment of riparian communities and diversify existing habitat where feasible.

4) Regeneration of cottonwood and willow stands from existing seed sources would be enhanced by site preparation. Timing of preparation with the relatively short duration of seed viability is critical.

5) Improve riparian zones by fencing out cattle along the reservoir, restricting campers to designated areas, instituting programs to eradicate salt-cedar (*Tamarix chinesis*) from the reservoir vicinity, and controlling noxious weeds.

6) Clearing woody vegetation would be limited in the new pool area to areas critical for safety or dam operations. Existing willows would be left wherever possible to speed the re-establishment of forage fish and juvenile predators after the construction drawdown. Large cottonwoods killed by the new pool would be left wherever possible to provide nesting and perching habitat.

2.3.9.6 Wetlands Mitigation

The project sponsors, in consultation with the U.S. Army Corps of Engineers (COE) and the U.S. Environmental Protection Agency (EPA), will determine wetlands mitigation requirements based on the wetlands functions and values that would be lost or degraded as a result of the proposed project. Wetlands mitigation measures would be designed to compensate for lost or degraded wetlands functions and values and would comply with Section 404 of the federal Clean Water Act, which authorizes COE and EPA to regulate activities that would place dredge or fill materials into wetlands and surface waters of the United States. Any wetlands mitigations required would be implemented as close as possible to the project site. Lands affected by mitigation measures would be prioritized to avoid conversion of high quality upland habitat (e.g., native prairie, woody draws, and forest communities). Each potential wetland mitigation site would be evaluated for adequacy of water supply, projected wetland functions and values, and benefits that would result from mitigation.

Potential wetland mitigation could include: recontouring Kendrick Flat (**see Figure 2-3**) and other ephemeral drainages to trap and retain sufficient natural runoff to establish a predominance of vegetation adapted to wetland conditions; constructing islands in the reservoir; retaining runoff in depressions excavated in upland sites and lined with impermeable material; and excavating depressions along the Tongue River floodplain to contact shallow ground water that would be available within the rooting zones of wetland plants. All mitigation projects would include seeding and transplanting with native species, and monitoring to ensure structural integrity of constructed features such as dikes and to detect the presence of noxious weeds.

2.3.9.7 Threatened and Endangered Species Mitigation

USBR (Albers 1995) prepared a draft Biological Assessment entitled *Biological Assessment: Tongue River Basin Project*. This document, included in **Appendix B**, states the project sponsors' commitments to eliminate or lessen the severity of adverse impacts to threatened, endangered, and candidate species occurring in the project area.

2.3.9.8 Cultural Resource Mitigation

Project elements that potentially could have an effect on cultural resources shall be conducted in accordance with a programmatic agreement amongst USBR, Montana State Historic Preservation Office, and the National Advisory Council on Historic Preservation. Possible cultural resource mitigations would be decided upon in consultation with appropriate parties and in consideration of comments received. The programmatic agreement will assure that federal agencies comply with laws that address protection of cultural resources.

DNRC has contracted for the preparation of a cultural resource inventory report entitled *Cultural Resources Investigations of the Tongue River Dam Project and Potential Irrigation Developments on the Northern Cheyenne Reservation.* This document is incorporated by reference into this draft EIS. Currently this report is being reviewed by USBR and other interested parties. It describes the cultural resources in the area of effect as defined by DNRC in 1992 and 1994. The report covers an unknown portion of the complete project area of potential effect (APE) since the complete APE remains undefined.

2.3.9.9 Coal Mine Facilities Mitigation

DNRC contracted a consultant to conduct a mitigation study entitled *Tongue River Dam Rehabilitation Project Decker Coal Company Mine Mitigation Study*. The purpose of the study was to assess the impacts of the proposed project on Decker Coal Company facilities and operations and provide methods and costs for mitigating potential impacts. The document organizes the assessment and mitigation study into ground and surface water components. This document is incorporated by reference into this EIS and is available on file at DNRC.

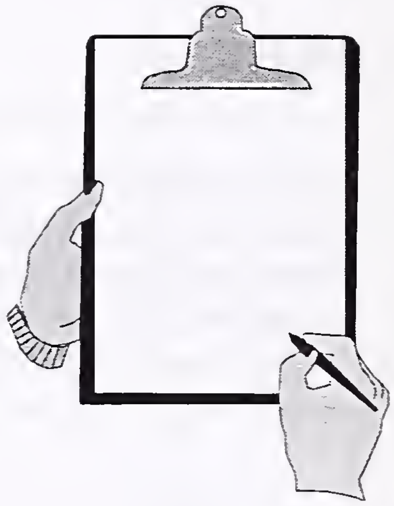
Ground water seepage into mine pits would increase as a result of the proposed rise in the water surface elevation of Tongue River Reservoir. Mitigation proposed for ground water seepage impacts included providing additional power for pumping and greater pumping capacity, additional sediment pond capacity, and obtaining permission to increase annual discharge under the Montana Pollutant Discharge Elimination System (MPDES) from Montana Department of Health and Environmental Sciences.

Surface water inundation at the mines (East Decker, West Decker, and the north extension of West Decker) would be associated with 100-year flood flows into the reservoir. Either the labyrinth weir or RCC alternative would accommodate the 100-year, 24-hour design flood which could impact soil stockpiles, monitoring wells, embankments, and water treatment and control facilities at the coal mines. Proposed mitigation for soil stockpiles included removal of the stockpiles or construction of protective dikes. Monitoring wells could be abandoned and replaced, or casings could be extended and an elevated access provided to the well locations. Embankments would be protected with approximately 22,000 cubic yards of riprap. Four MPDES monitoring stations would require replacement as mitigation if either action alternative was constructed. Water Treatment/Control Pond R-1 at East Decker Mine would require mitigative reconstruction if the RCC alternative was constructed.

2.3.9.10 Recreation Mitigation

The project sponsors propose a program of recreational mitigations at the Tongue River State Park to replace existing facilities. DFWP also proposes to conduct a program of recreational improvements at the state park. A number of these improvements are cost-shared with the project sponsors' mitigations. These shared improvements/mitigations are described below and presented in **Figure 2-12.** (DFWP's planned park improvements that are not cost-share items are discussed under Reasonably Foreseeable Activities.)

THIS PAGE INTENTIONALLY LEFT BLANK



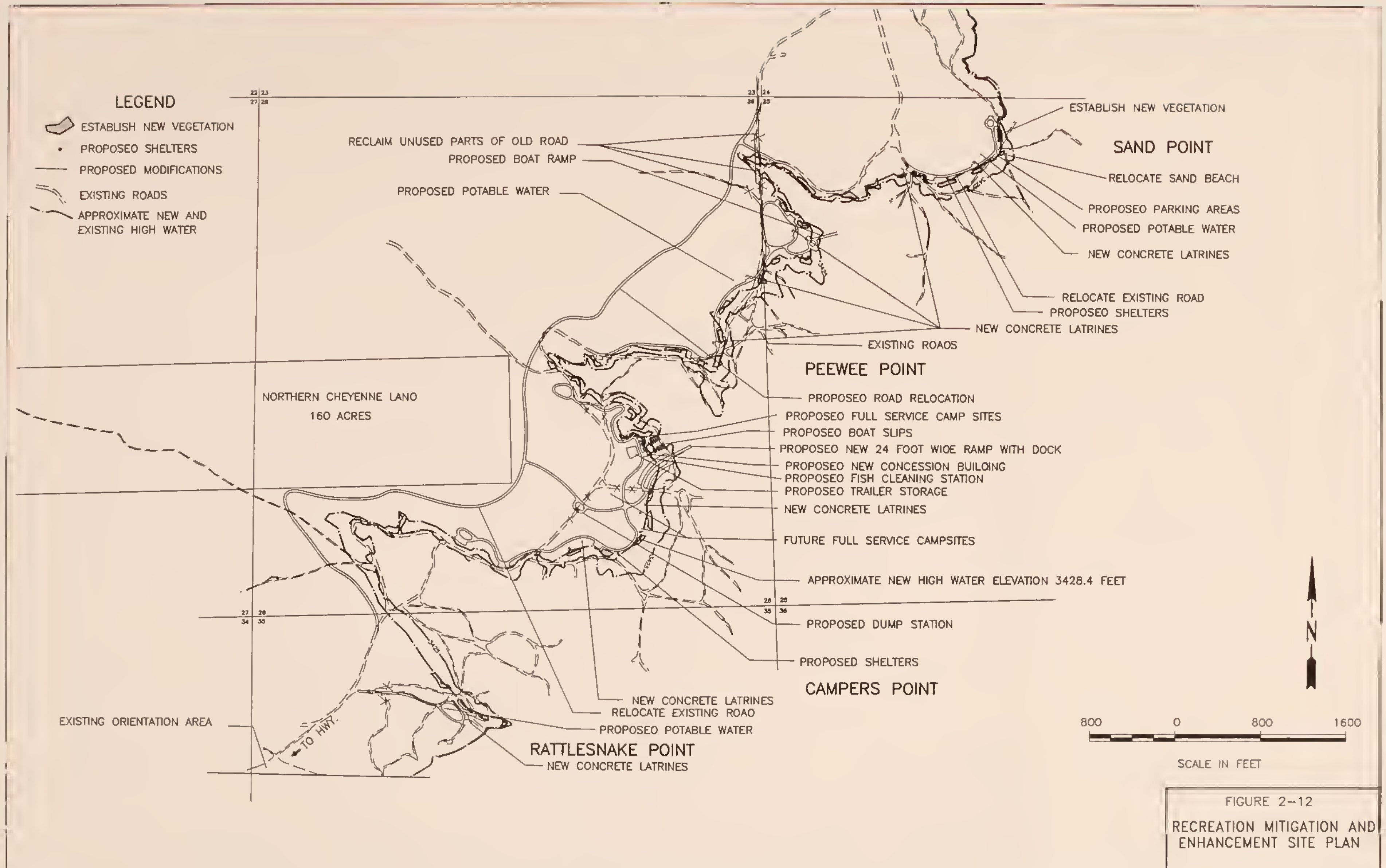


FIGURE 2–12
RECREATION MITIGATION AND ENHANCEMENT SITE PLAN

1) About 3,000 feet of new or relocated internal park roads would be built to accommodate the new water level and park facilities. About 5,600 feet of existing internal roads would be reclaimed.

2) The existing 100-foot-by-50-foot man-made sand beach at Sand Point would be relocated above the new water line.

3) A new 200-foot-by-24-foot boat ramp would be built at Campers Point to replace the existing ramp that would be inundated.

4) A new 80,000-square-foot parking area at the ramp would be developed to accommodate boat launching and removal.

5) The existing concession building at Campers Point would be relocated above the new water line or, if necessary, would be replaced.

6) A new well and septic system would be developed to replace the existing facility at Campers Point.

7) Eighteen single latrines (handicap accessible) would replace 11 existing single and three double latrines.

8) Eleven new picnic shelters would replace nine existing shelters.

9) About 7,600 linear feet of shoreline would be revegetated at full pool.

10) Thirty fire rings would be replaced or relocated to areas suitable for camping and/or day use.

Recreation mitigations would be implemented during the construction and reclamation phase of the project.

2.3.9.11 Geologic Mitigation

DNRC recently has placed a permanent benchmark above the landslide and several monitoring points in the slide area located at the northeast end of the reservoir in Section 13, T8S, R40E (see Chapter 3, Geology). These benchmarks will be monitored to alert management agencies if ground movement were observed. Appropriate measures would be taken if such movement occurred.

2.3.9.12 Transportation Mitigation

In order to mitigate transportation-related impacts, the following measures are proposed:

1) County Road No. 380 would be relocated, and reconstructed. The relocation would be mostly complete before major material hauling to the dam site began, to safely accommodate recreational traffic.

2) From Site No. 1 to the dam, County Road No. 380 would be closed to all but necessary local traffic during times of heaviest construction. A 1-mile reach of the road would be rerouted away from the staging area. Construction gates would be used to limit access onto the road. Since most campgrounds and picnic areas are outside of this section of roadway and there are no nearby boat ramps or docks, inconvenience to recreationists would be minor.

3) When construction at the dam site was complete, County Road No. 380's gravel would be replenished and regraded where needed, borrow pits would be cleaned and reshaped, damaged culverts would be cleaned and reshaped, and signs or other features repaired.

4) The intersection of County Road No. 380 and Secondary Highway 314 would be evaluated before construction began and monitored during construction to determine adequacy and safety for truck traffic. Measures to accommodate larger trucks would be implemented as required and may include widening of the intersection and moving existing traffic control signs.

5) Signing would be used to advise and warn the traveling public of heavy construction traffic on Secondary Highway 314 and County Road No. 380. All construction signing would be removed upon completion of this proposed action.

6) Speed restrictions of 15 MPH for trucks hauling materials through the residential area of Sheridan, Wyoming would be considered in conjunction with area residents and city officials in the event that a rail load-out were used in Sheridan.

7) Dust control along County Road No. 380, in the construction staging area, and in Sheridan, Wyoming (in the event that the Sheridan rail load-out were used), would be conducted when necessary by sprinkling with water or application of a dust palliative such as magnesium chloride.

8) If necessary, hauling major construction materials would be restricted to 7:00 a.m. to 9:00 p.m. to avoid nighttime disturbance of residents in Sheridan, Wyoming and to campground users at the reservoir.

2.3.9.13 Fish and Wildlife Habitat Enhancement Features

The Northern Cheyenne Indian Reserved Water Rights Settlement Act of 1992 allocated $4.6 million for enhancement of fish and wildlife habitat in the Tongue River Basin. The funds are to be used pursuant to P.L. 89-72, with a cost-share arrangement of $3.5 million in federal funds and $1.1 million in state funds. The enhancement features discussed herein apply to either action alternative and may be implemented regardless of the action alternative selected. Enhancement planning for the Tongue River Basin Project has been carried out in conjunction with and parallel to other project planning, project impact mitigation planning, and environmental impact assessment and statement preparation processes. The enhancement planning activity is focused on the improvement of aquatic and terrestrial habitat in the Tongue River Basin.

The enhancement planning process was initiated with the formation of the Interagency Mitigation and Enhancement Team (Team) and the subsequent compilation of a list of potential enhancement features, concepts, and ideas for projects. The Team is comprised of the project sponsors, Montana Department of Fish and Wildlife and Parks, U.S. Fish and Wildlife Service, and the Bureau of Indian Affairs. Final selection of site-specific projects would be made by the project sponsors with input from the Team.

Biological diversity and ecosystem management were the two main principles guiding enhancement measures. By restoring, protecting, and/or enhancing critical habitat components within the Tongue River Basin via measures such as those discussed herein, the project sponsors would foster biological diversity. Other proposed enhancements address ecosystem management by reintroduction of some species (e.g., bison), eradication of unwanted species (e.g., salt-cedar), and maintenance of healthy biotic communities. For a further discussion of biological diversity and ecosystem management, see Chapter 3, Biological Diversity.

The enhancement features in this section are presented in a programmatic fashion to illustrate the types of projects under consideration. As planning for the enhancement features continues, site-specific projects will be identified and evaluated under the appropriate NEPA/MEPA compliance process. The enhancement planning process recognized the need for cooperative, educational, and other programs that are not site-specific to allow the project sponsors the latitude to select projects that would be the most beneficial for habitat enhancement as they become evident. For example, as a particular piece of land with high habitat value becomes available for acquisition by purchase or easement, a site-specific project would be developed.

Listed below are the types of projects or programs currently under consideration as enhancement features. Site-specific enhancement measures may include aspects of one or many of the features listed. A description of the listed features is included in Appendix C.

1) Acquire lands of high habitat value through purchase or easement to enhance or protect those values.

2) Develop and enhance existing wetland sites.

3) Develop stock pond/small wetlands.

4) Construct wetlands.

5) Enhance aquatic habitat.

6) Enhance riparian habitat.

7) Enhance upland habitat by providing water, shelter belts, dense nesting cover, food plots and sediment control.

8) Enhance instream flows through: 1) a water rights acquisition program; 2) monitoring and enforcement of diversion; 3) a streamflow gaging program.

9) Provide fish passage around diversion dams.

10) Screen inlet structures at diversions.

11) Initiate livestock management and exclusion systems.

12) Enhance the Tongue River Reservoir perimeter.

13) Install bird-nesting structures along the Tongue River corridor and reservoir shoreline.

14) Remove trash and car bodies from selected sites.

15) Develop weed control programs.

16) Develop cooperative programs with private landowners and agencies and develop a habitat conservation education program as part of an overall ecosystem management planning activity.

17) Provide short grass/native prairie ecosystem management/enhancement on the Northern Cheyenne Reservation including prairie dog re-establishment in plague-affected areas on the reservation, and a bison restoration program.

2.3.10 Alternative 2 Roller-Compacted Concrete (RCC) Spillway

The project sponsors considered an RCC alternative because it was cost-effective and achieved project goals. RCC is considered a cost-effective alternative because it uses lesser amounts of expensive materials and is less labor-intensive to place. RCC uses less cement and reinforcing steel than structural concrete and thus has less strength. This is acceptable because it is used only to cap the earthen dam and protect it from erosion. The RCC cap would serve neither as the primary structure of the dam nor as the primary spillway.

Under this alternative, the existing spillway would be replaced by a new primary spillway in the left abutment made with a reinforced concrete chute at crest elevation 3,428.4 feet (**see Figure 2-13**). The primary spillway would be about 190 feet wide at the crest, tapering to about 100 feet at the toe of the dam. Its chute would taper correspondingly. A stilling basin would sit at its base (**see Figure 2-14**).

In addition to the primary spillway, an RCC spillway would be built over the modified dam embankment (**see Figure 2-15**). The RCC spillway would have two components: a secondary spillway at elevation 3,429.4 feet and an emergency spillway at elevation 3,431.4 feet. The three spillways would be built at different elevations, with the primary at the lowest and the emergency at the highest. The primary spillway would pass a common flood of about 10,000 cfs, and the RCC spillways would accommodate the combined 100,000 cfs spillway design flood. The primary and secondary spillways would have an approximate capacity of 11,135 cfs. Peak outflow from the primary and secondary spillways during the 30-day 100-year flood would be about 11,135 cfs versus 10,249 cfs for the existing spillway. A comparison of spillway performance at different flood events is shown on **Figure 2-4.**

This alternative changes the traditional understanding of how a dam functions; the RCC portion acts as both the dam for lower runoff (normal operation) and as a spillway during flood flow. Floods up to a 100-

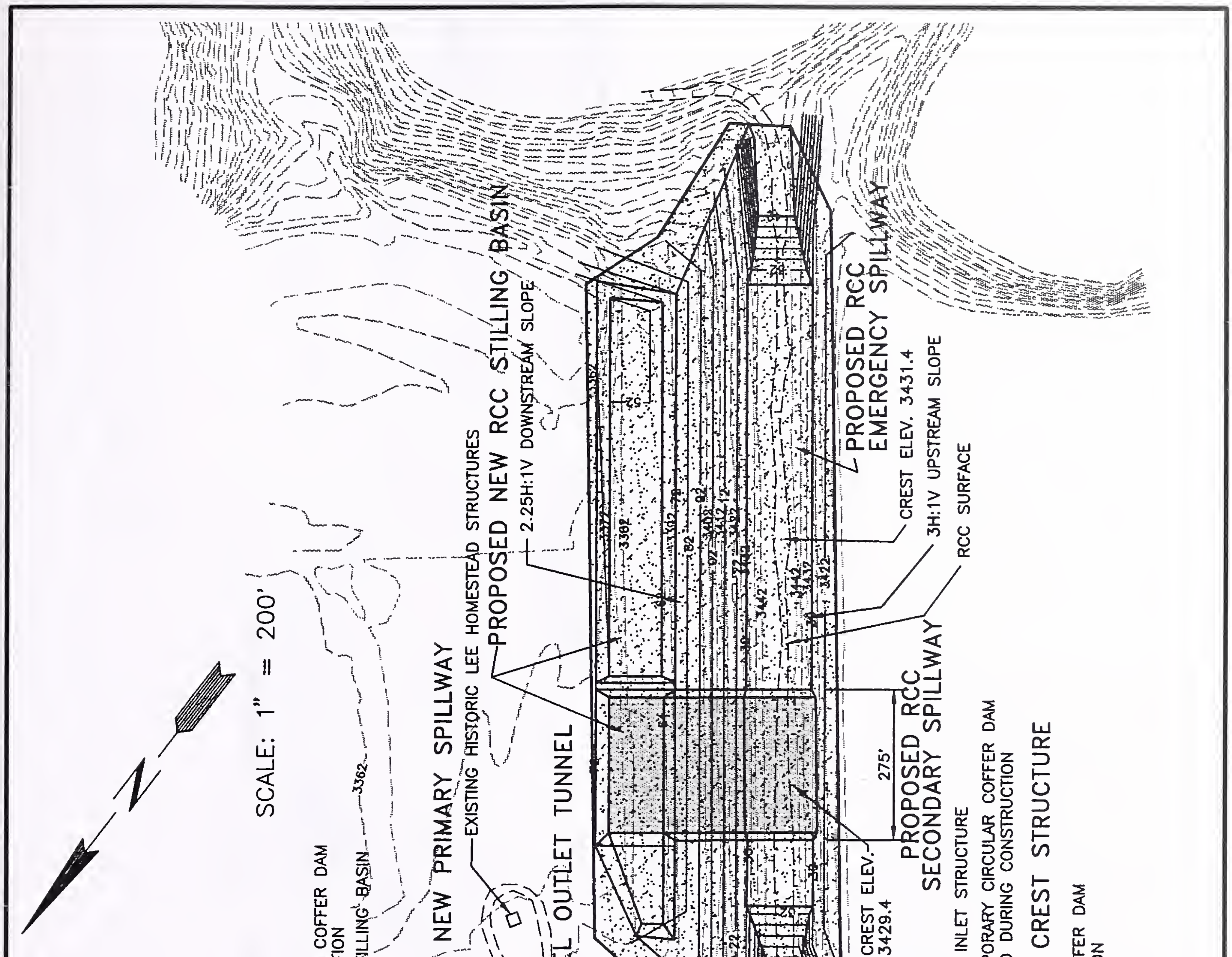


FIGURE 2–13

RCC SPILLWAY SITE PLAN

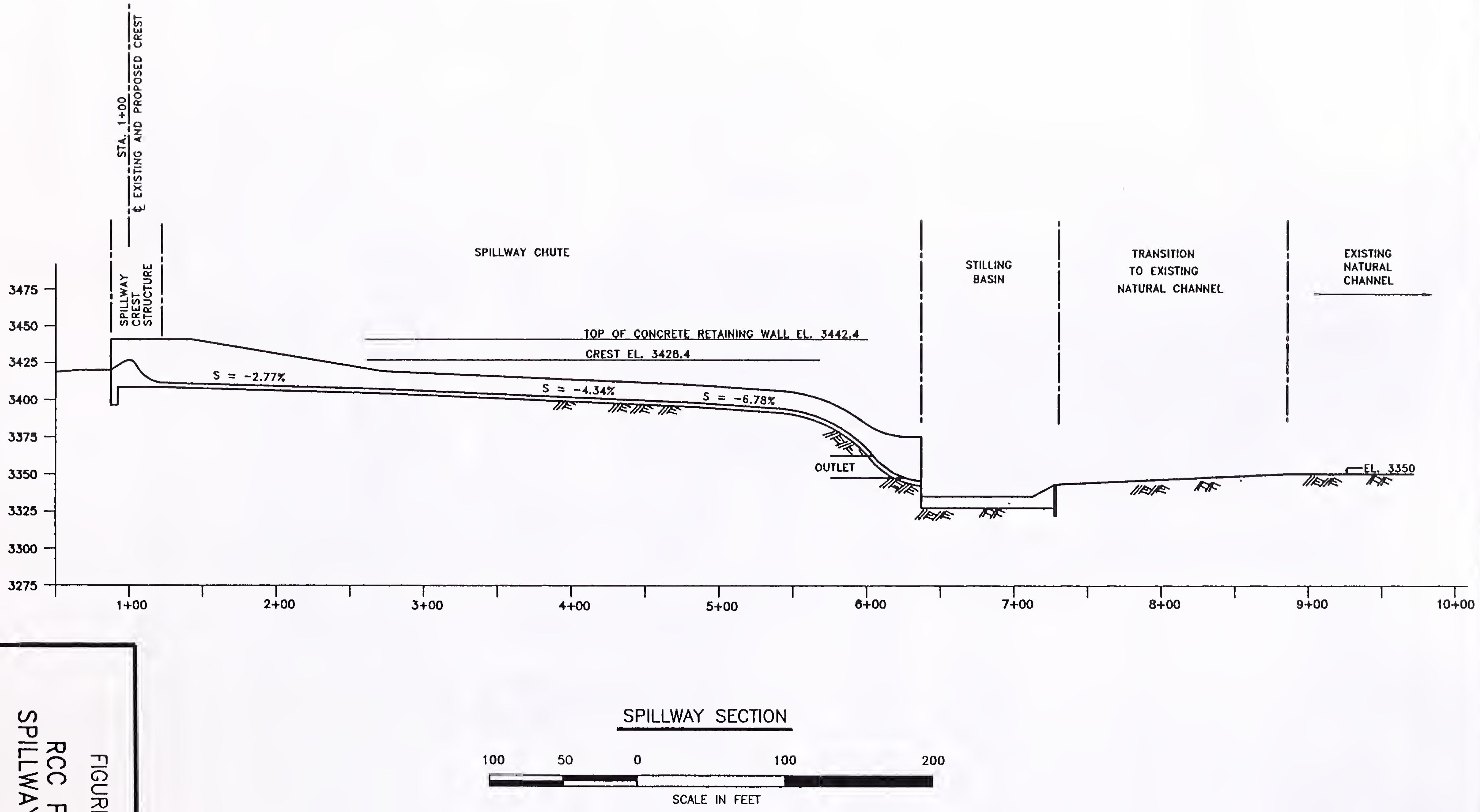


FIGURE 2-14
RCC PRIMARY
SPILLWAY SECTION

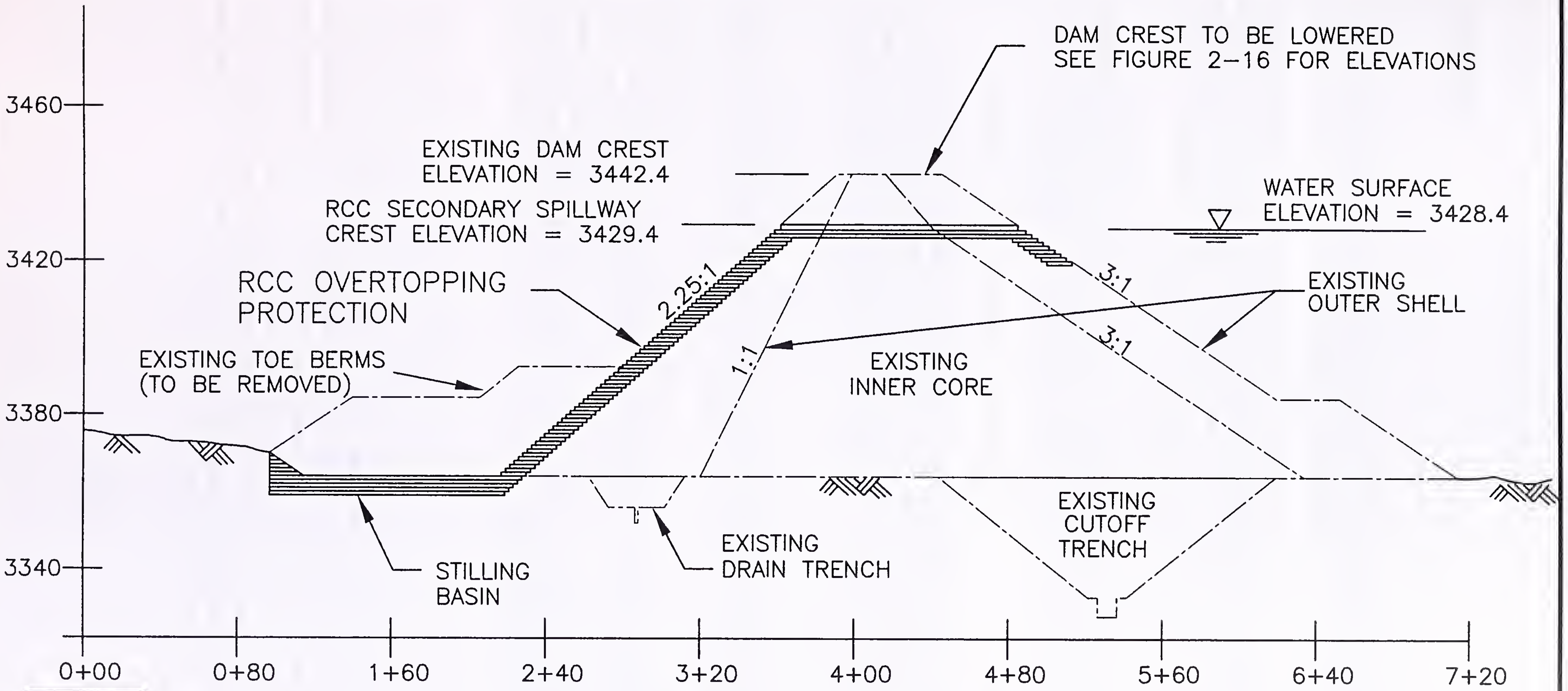


FIGURE 2–15

RCC SECONDARY SPILLWAY SECTION

year event would be routed over the left abutment primary spillway and possibly the RCC secondary spillway constructed over the dam embankment. Runoff events larger than the 100-year flood would use the RCC emergency spillway in addition to the primary and RCC secondary spillways.

The secondary and emergency spillways would discharge to the stilling basin at the toe of the dam. From the stilling basin, discharge would flow across the floodplain. The primary spillway would discharge water to the channel downstream in a manner similar to the existing spillway. The downstream flood stages could be 0.4 foot higher than the existing condition, or 10.8 feet deep. The average floodplain width would be about 387 feet or about equal to the existing average floodplain width of 361 feet.

The proposed 4-foot increase in reservoir elevation from 3,424.4 to 3,428.4 feet would increase the reservoir's capacity from 67,000 acre-feet to 80,000 acre-feet. The reservoir surface area at the spillway elevation would increase approximately 400 acres from 3,198 to 3,612 acres (see **Figure 2-3**).

2.3.10.1 Primary Spillway

Depending on its condition, the existing spillway would either be removed or rehabilitated. A narrower, reinforced concrete chute spillway would be constructed along the existing spillway centerline as shown in **Figure 2-13**. The new spillway would have an improved spillway chute to avoid the standing waves that affect the performance of the existing spillway. The spillway would include a crest section at elevation 3,428.4 feet.

Portions of the existing dam crest would remain in place and would not be covered by RCC. During the 100,000 cfs spillway design flood, 4 feet of freeboard (space) would remain between the reservoir water surface and the existing dam crest elevation to prevent overtopping by wave action.

Under the RCC alternative, two stilling basins would be built; one at the toe of the primary spillway and one at the toe of the RCC spillways. The primary stilling basin would be 90 feet long and 100 feet wide. The bottom would be about 15 feet below the natural stream channel. Construction of the primary stilling basin would require passage of water from the outlet works through a flume. This temporary flume would bypass the stilling basin and discharge downstream of a coffer dam (see Coffer Dams). The stilling basin area also would have to be dewatered during construction because of ground water's proximity to the surface. This would be done the same as discussed under Alternative 1.

2.3.10.2 RCC Spillways

The combined RCC spillways (secondary and emergency) could measure up to 1,200 feet wide at their crest and drop about 90 feet to a stilling basin (see **Figure 2-15**). The secondary spillway would have a minimum crest elevation of 3,429.4 feet. It would be constructed in the middle of the dam embankment as shown in **Figure 2-13**. If scoria was used as an aggregate and produced RCC that needed protection from freeze-thaw conditions, then exposed surfaces of the RCC spillways would be protected with a structural concrete or earthen cap. Scoria is a lightweight aggregate susceptible to freeze/thaw damage. Scoria is more subject to erosion and more porous than aggregate available at Site No. 1, however, it has been used successfully as RCC aggregate on other similar projects.

The crest section of the combined spillways would be level and its ends sloped up to the dam crest to allow vehicular traffic to cross the dam. RCC construction would also produce steps on the spillway face to dissipate energy from water falling swiftly over the chute.

The stilling basin for the RCC spillways would be 100 feet long and up to 1,200 feet wide. The bottom would be about 10 feet below the existing floodplain. No coffer dam would be necessary for construction of this stilling basin because no surface water currently flows directly below this proposed structure. However, the stilling basin construction area would still have to be dewatered.

During flood events, water coming out of the RCC stilling basin would find its own path across the existing floodplain. This differs from the labyrinth weir spillway and the primary spillway in that all flood waters would be discharged to the tailrace channel. A tailrace is a channel between the stilling basin and the natural channel of the river (**see Figure 2-7**).

2.3.10.3 Dam Embankment Modifications

Depending on its final width, the RCC overlay probably would require at least partial removal of the toe berms (large steps on the embankment) so that the downstream dam face would provide an unbroken plane for discharge of extremely high flows over the dam crest. These toe berms are made of scoria, and therefore, are a possible source of aggregate for the RCC Spillway. RCC likely would be constructed in 1-foot-high lifts, about 12-feet wide and achieve an overlay thickness of at least 4 feet as shown in **Figure 2-15**.

The existing crest of the dam is 18 feet higher than the current spillway elevation. Under this alternative, the existing elevation of the dam crest would be lowered a maximum of 13 feet. The difference in elevations between the existing and proposed dam crests would allow the RCC component to be built (**see Figure 2-16**).

2.3.10.4 Rehabilitation of Existing Low Level Outlet Works

Under Alternative 2, the proposed improvements to the existing low level outlet works would be similar to Alternative 1 and would include an air shaft to provide sufficient aeration and other hydraulic improvements to prevent erosion that occurs just downstream of the gates (**see Figure 2-17**).

Downstream releases during rehabilitation of the low level outlet works could be made by a temporary bypass structure placed in the low level outlet works or by an auxiliary low level outlet works. The temporary bypass structure would include the installation of a temporary bulkhead with a control gate in the inlet structure. The placement of the bulkhead would allow the installation of a temporary pipe within the low level outlet works conduit and placement of the new control gates and construction of the new conduit lining. Upon completion of the low level outlet works rehabilitation, the temporary pipe and bulkhead would be removed by lowering the reservoir and lifting the bulkhead out using a crane from shore or a barge-mounted crane.

Alternative 2 could include an auxiliary low level outlet works. The need for the auxiliary outlet under Alternative 2 would be evaluated during final design. Because preliminary design details, construction requirements, and impacts associated with an auxiliary outlet works are discussed under Alternative 1,

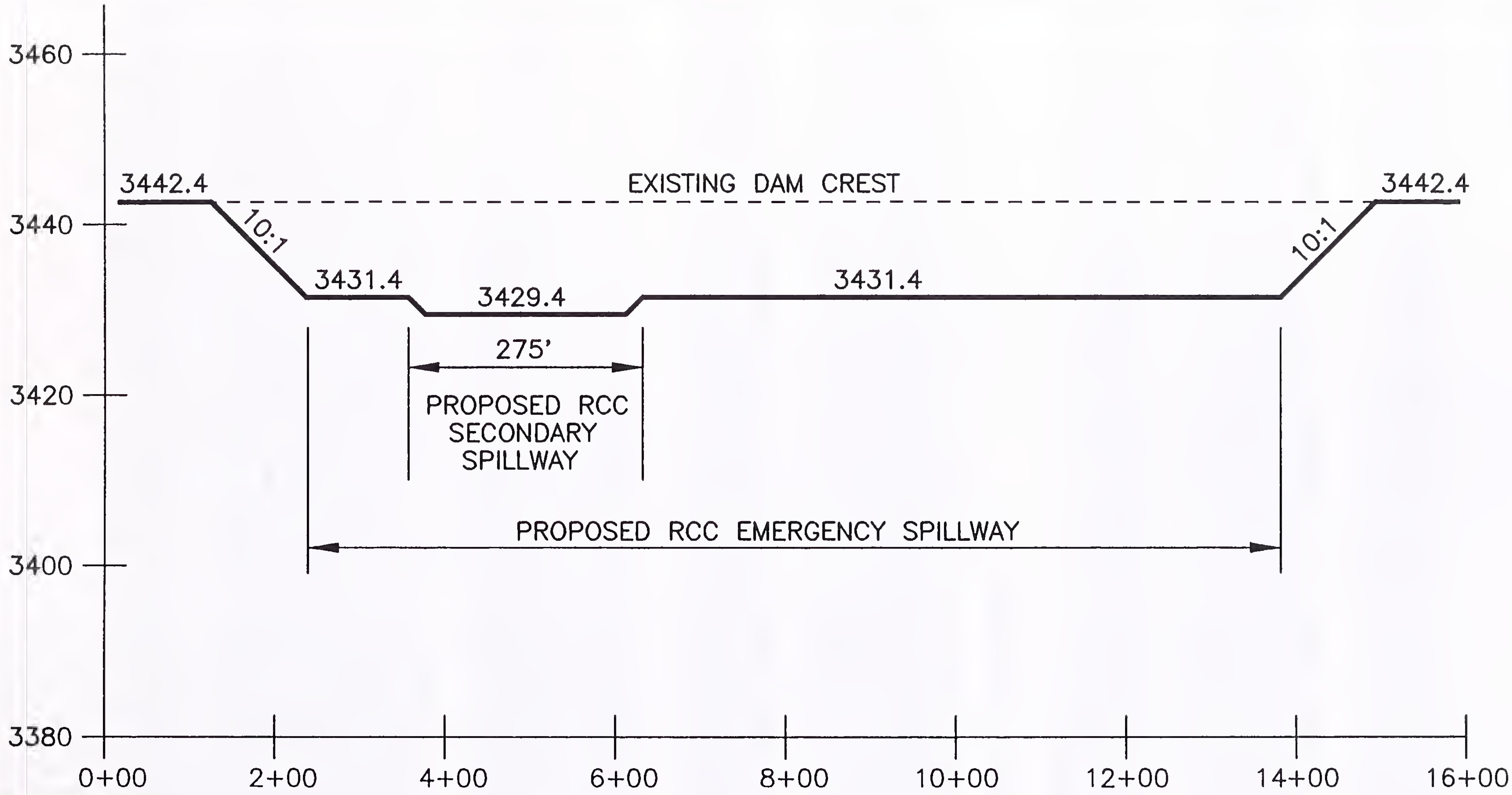


FIGURE 2–16

RCC SPILLWAY DAM CREST PROFILE

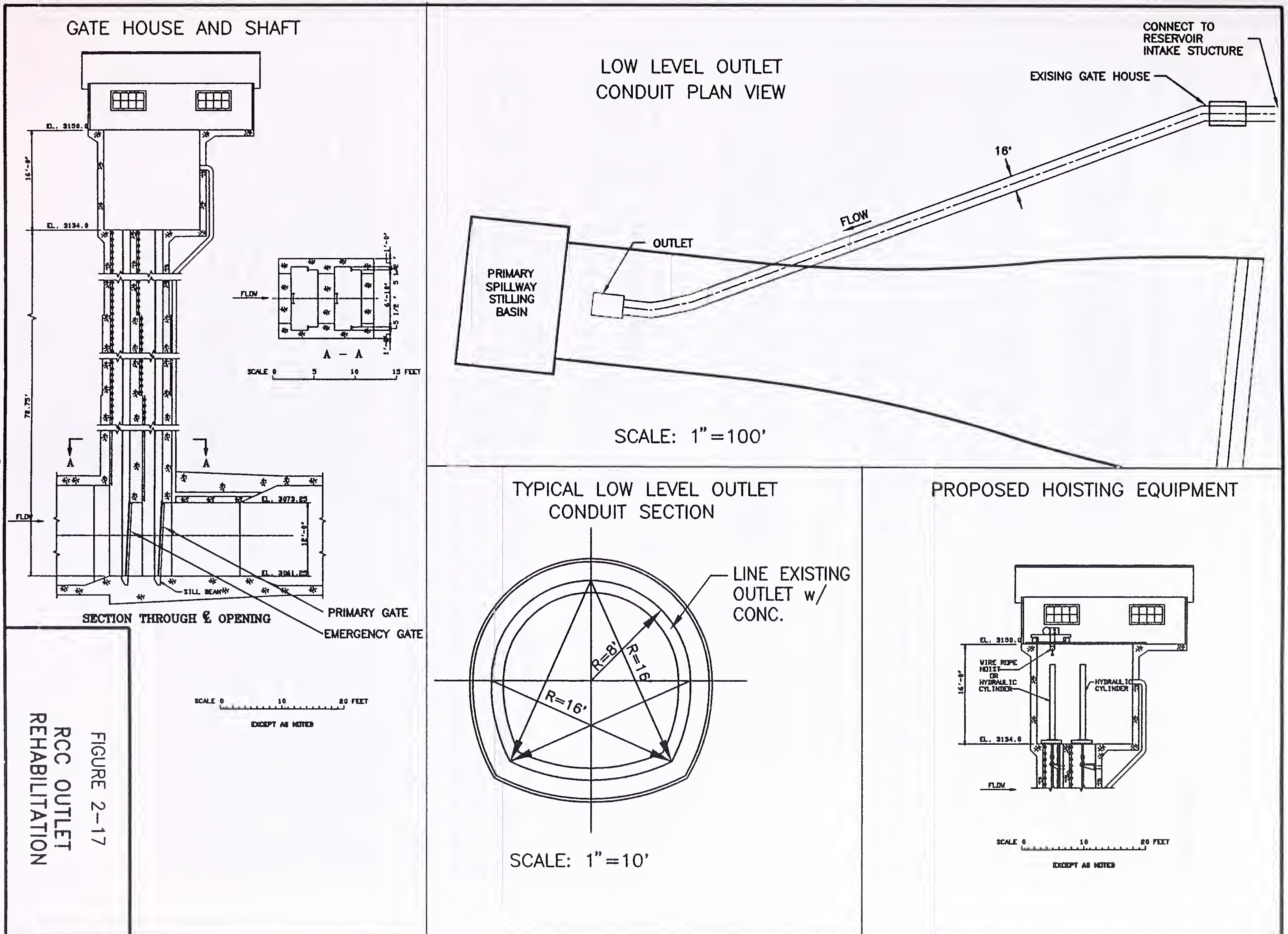


FIGURE 2–17

RCC OUTLET REHABILITATION

Alternative 2 describes in greater detail the use of a temporary bypass so as to provide as much information as possible for the project sponsors and the public. The auxiliary outlet under Alternative 2 could be constructed with a mid-level intake at about elevation 3,380 feet and a capacity of about 600 cfs. The auxiliary low level outlet would provide the following benefits:

- During rehabilitation of the existing low level outlet works, it would allow greater capacity to pass high inflows around the project. It also would allow releases of 190 cfs to protect downstream fishery and aquatic resources at all times, reducing the risk of overtopping the coffer dams.

- The use of an auxiliary low level outlet works would avoid the need for the installation of a temporary stream bypass in the existing outlet . This would result in less complicated and costly rehabilitation of the existing low level outlet works, would avoid the cost of the temporary stream bypass, and would avoid impacts to downstream fishery and aquatic resources due to reduced flows.

- The use of an auxiliary low level outlet works would also result in future benefits. It would allow streamflows to be released during periods when the main outlet was being inspected or repaired and would avoid any impact to downstream fishery and aquatic resources during these periods.

Proposed rehabilitation of the existing outlet would include replacement of the existing 6-foot-wide by 12-foot-high roller gates with new similar sized gates as shown on **Figure 2-17**. The new gates would provide a discharge capacity similar to the capacity of the existing gates. This capacity would be sufficient to reduce the reservoir from full pool to 25 percent of capacity in 25 days or less (USBR reservoir evacuation standards).

The existing downstream outlet conduit has operated successfully for about 55 years and is in serviceable condition. It might require a 12-inch reinforced concrete liner to provide another 50+ years of service but would continue to exit near the downstream toe and centerline of the spillway chute. The need for the liner would be confirmed during the final design phase of the project.

2.3.10.5 Coffer Dams

An upstream coffer dam having a crest elevation of 3,442 feet would be constructed to prevent reservoir water up to a 25-year flood event from entering the spillway construction area. This dam would be up to 20 feet high and 8 to 12 feet wide at the crest and about 100 feet wide at the base. It would extend from the left abutment to the existing dam, about 400 feet long. The difference between the dimensions in the coffer dams (between alternatives) is accounted for in their placement; the RCC coffer dam would be across the throat of the existing spillway approach and the labyrinth weir coffer dam would extend onto the receding floor of the reservoir. The RCC coffer dam would allow the reservoir to store up to 45,000 acre-feet of water. A dewatering system also would be required to remove seepage flows from the construction area.

A downstream coffer dam would be placed just beyond the proposed primary stilling basin to allow diversion of streamflows around stilling basin construction. This dam would be relatively small, measuring about 10 feet high and 100 feet across.

In order to rehabilitate the low level outlet works, a cellular coffer dam may be constructed around the inlet structure (**see Figure 2-13**). This coffer dam could be constructed of earthfill or steel sheet piling, or a combination of both. (A cellular coffer dam is totally enclosed to isolate the inlet structure.) Under this alternative, water levels in the reservoir would be drawn down to elevation 3,390.5 feet or 9,000 acre-feet. This means that 5,000 to 15,000 acre-feet of water would have to be released into the river prior to construction. Water releases of 190 cfs and a one-time short-term (less than 2 weeks) release of not less than 25 cfs would be maintained in the river in late fall and early winter of 1997-1998. Flows would be provided either by pumping or by a temporary bypass structure or auxiliary outlet to allow the diversion of streamflows around construction.

2.3.10.6 County Road Improvements

County road improvements would be the same as those proposed under Alternative 1.

2.3.10.7 Structure and Shore Erosion Protection

Structure and shore erosion protection measures would be the same as for Alternative 1.

2.3.10.8 New Bridge Access

New bridge access would be the same as discussed under Alternative 1.

2.3.10.9 Construction Staging Area

The construction staging area would be the same as discussed under Alternative 1, except for the following:

- Up to 400,000 cubic yards of soil, rock, and scoria ultimately would be deposited in the waste area as opposed to the 500,000 cubic yards proposed under Alternative 1. About 400,000 cubic yards of materials would be excavated to construct the RCC spillway and the new primary spillway. Approximately 100,000 cubic yards of these materials could be used as aggregate for the RCC emergency spillway depending on their suitability. The remaining 300,000 cubic yards temporarily could be used for the coffer dams or other purposes but eventually would be disposed of in the waste area shown on **Figure 2-7.**

- Aggregate Site No. 2 is composed of the existing dam embankment, toe berms on the dam embankment, and adjacent alluvial valley floor extending north from the construction staging area (**see Figure 2-7**). A berm between Site No. 2 and the river would be provided. The detailed site plan developed during final design would give special attention to sediment control and protection of the adjacent wetlands and riparian vegetation to the north of the embankment and the historic Lee Homestead structures.

Site No. 2 has been selected by DNRC as a possible source of aggregate for the preparation of RCC. This alternative requires that the two berms at the base of the dam be removed. If the scoria that comprises the toe berm and downstream shell of the dam (Site No. 2) is shown to be suitable for use in RCC, it would be used to the maximum extent possible to keep aggregate hauling from other locations to a minimum. The toe berms were included in the construction of the original dam. The scoria may be of sufficient quantity and quality for RCC batching activities. As much as 343,000 cubic yards of material would be removed from the dam crest and downstream toe berm. The existing dam embankment contains an estimated 1,225,000 yards of material. Material suitable for RCC construction would be stockpiled on site and used in the RCC mix. If scoria were found to be unsuitable for RCC, aggregate from downstream alluvium (Site No. 2) and possibly Site No. 1 would need to be trucked to the RCC batching site. Unsuitable materials would be disposed of in a waste area used during the original construction and located downstream of the dam west of the river as shown in **Figure 2-7**. Site No. 2 would be operated from spring to fall of 1997.

Site No. 2 would have to be sampled to verify the suitability and amount of aggregate available and its characteristics. Processing the aggregate could require the use of screening for the size distribution required.

2.3.10.10 Railroad Unloading Facilities

Railroad unloading facilities would be the same as discussed under Alternative 1.

2.3.11 Material Requirements

2.3.11.1 Primary Spillway

Structural Concrete Aggregate and Cement. Construction of the primary spillway would require approximately 13,400 cubic yards of aggregate and 12,100 tons of cement. The aggregate would be provided from Site No. 1, as discussed under Alternative 1 and shown in **Figure 2-3**.

Reinforcing Steel. About 695 tons of reinforcing steel would have to be hauled to the construction staging area in the same manner as that for Alternative 1. The materials would be stockpiled on site for use.

2.3.11.2 RCC Spillway

RCC Aggregate and Cement. Up to 100,000 cubic yards of aggregate and 4,000 tons of cement would be required for the RCC spillway. Site No. 2 shown on **Figure 2-7** would be the primary source of aggregate, if the source is suitable, and could provide sufficient quality for use in batching RCC.

If a structural concrete cover were used to protect the scoria RCC, then an additional 23,200 cubic yards of structural concrete aggregate would be required from Site No. 1. Six thousand tons of additional cement also would be required.

2.3.11.3 Low Level Outlet Works

Estimated quantities of materials for rehabilitation (including lining) of the low level outlet works include: two sealing gates and hydraulic operators, approximately 1,527 cubic yards of concrete and 78 tons of reinforcing steel. If an auxiliary low level outlet works was incorporated into this alternative, then quantities of materials required would increase.

2.3.11.4 Coffer Dams

Coffer dams would require approximately 23,000 cubic yards of earth fill material from the dam crest. Final design may indicate that steel sheet piling could be required for portions of the coffer dams. If steel sheet piling was necessary, the amount (tons) needed would be identified during final design.

2.3.11.5 County Road Improvements

Material requirements for road improvements related to the RCC alternative are estimated to be the same as proposed under Alternative 1.

2.3.11.6 Structure and Shore Erosion Protection

Material requirements for structure and shore erosion protection are estimated to be the same as proposed under Alternative 1.

2.3.12 Material Hauling

The details of aggregate hauling, such as time-of-year, truck numbers and sequencing, and safety considerations, would be developed during final design. Actual construction sequencing requirements, available staging area, and aggregate production capacity may limit the number of trucks and trip frequency, extending the number of days required to move the necessary tonnage.

Approximately 850 trips would be made to and from the staging area via County Road No. 380, Secondary Highway 314, Secondary Highway 338 and, possibly, Interstate Highway 90 for other construction materials such as reinforcing steel and cement. Materials hauling could be staged strategically over the 4-to-5-month period prior to and including preconstruction project activities such as mobilization and demolition. While a larger network of highways would be impacted by the construction material hauling, the delivery schedules would be planned during final design in a manner to minimize impacts on traffic.

Material hauling associated with rail and truck haul of riprap, county road improvements, and mitigation activities would be the same as for Alternative 1.

2.3.12.1 RCC Spillways

Disposal of the existing spillway materials (see below) and excess excavation required to construct the spillway would require 15,000 round trips between the spillway excavation and the waste area using equipment with a 20-cubic-yard capacity.

Aggregate for the RCC primary spillway would require an estimated 620 round trips by 20-cubic-yard capacity trucks between aggregate source Site No. 1 and the construction staging area. Reinforcing steel would have to be hauled to the construction staging area on County Road No. 380. Assuming 15-ton loads per trip, about 50 trips would be required to transport the reinforcing material to the staging area.

Site No. 2 is immediately adjacent to the staging area and the haul distance would be very short. Assuming 20 cubic yards per trip, approximately 5,000 trips would be required to transport the aggregate materials within the staging area.

2.3.12.2 Low Level Outlet Works

About 185 truckloads of mixed concrete would be transported from the staging area to the outlet works sites by trucks and pumps for the low level outlet works.

2.3.13 Major Construction Activities

2.3.13.1 Reservoir Drawdown and Downstream Releases During Construction

Construction of the RCC spillway alternative would require drawdown of the reservoir for two activities:

- rehabilitation of the low level outlet works and construction of auxiliary outlet works, if included; and
- construction of the new primary spillway.

Preliminary analysis by DNRC indicates that the project may be able to store up to 45,000 acre-feet of contract water during construction. The amount stored would depend on the alternative selected, the actual construction schedule, and the risk of acceptable flooding during construction.

Rehabilitation of the low level outlet works would require drawdown of the reservoir to elevation 3,390.5 feet (9,000 acre-feet of storage) over a 1-month period in late fall of 1997. A cellular coffer dam may be constructed around the inlet structure and a temporary bypass structure constructed in the existing low level outlet works to allow the diversion of streamflows around the project. The reservoir would be held at elevation 3,390.5 feet until the outlet rehabilitation and the upstream coffer dam were completed in the winter of 1997-1998. The reservoir would then be refilled up to 45,000 acre-feet, as streamflows allowed, during the spring of 1998.

During the construction period, a target release of 190 cfs with an allowable one-time short-term (2 weeks) release of not less than 25 cfs would be maintained through the low level outlet works and the temporary bypass to reduce impacts to aquatic life and fisheries. This minimum, provided via pumping during installation of the bypass, would be used only during times of the year when icing and heat-load conditions were acceptable (fall and spring).

DNRC proposes that downstream agricultural losses during construction would be mitigated the same as discussed under Alternative 1 (i.e., supply run-of-river releases, monitor downstream flows, and storing water for delivery to contract holders).

2.3.14 Overall Construction Schedule

2.3.14.1 Description of Construction Steps

The sequence of construction activities is shown in **Figure 2-18.** Estimated time requirements and scheduling of each construction activity is shown in **Figure 2-19.**

2.3.14.2 Employment Requirements

Tribal hiring preferences would be the same as for Alternative 1.

Preconstruction Employment. Estimated employment required preceding construction would be the same as for Alternative 1, shown on **Table 2-1.**

Construction Employment. Employment requirements during construction would be lower for Alternative 2 than for Alternative 1. Employment requirements are shown on **Table 2-5.** Employment scheduling is shown on **Figure 2-20.**

Mitigation Employment. Employment requirements for mitigation would be the same as for Alternative 1, which are shown on **Table 2-3.**

TABLE 2-5
Estimated Employment During Construction for Alternative 2

TASK	SKILLED LABOR BY TASK AND CREW SIZE	SEMI-SKILLED LABOR BY TASK AND CREW SIZE	TOTAL EMPLOYMENT
Site work and reclamation	5	3	8
RCC placement	5	3	8
Spillway repair	12	2	14
Outlet rehabilitation	2	4	6
TOTALS	24	12	36

2.3.15 Probable Construction Cost Estimate

RCC is a cost-effective construction material. The probable construction cost estimate for Alternative 2 is shown in **Table 2-6** and equals $16,560,200 for the dam safety improvements. (If an auxiliary low level outlet works was built, this alternative is estimated to cost $17,560,200.) This cost does not include

TABLE 2-6
Probable Construction Cost Estimate for RCC Spillway

DESCRIPTION	QUANTITY	UNIT	UNIT $	AMOUNT
Mobilization		LS		$716,900
Excavation				
Clay	68,100	cy	5	340,500
Common Earth	274,800	cy	3.5	961,800
RCC	100,000	cy	40	4,000,000
Drain Trench	400	cy	30	12,000
Drain Pipe	6,600	lf	12	79,200
Fill	21,300	cy	8	170,400
Concrete Demolition	4,500	cy	103	463,500
Concrete Slabs	3,900	cy	220	858,000
Concrete Walls	9,500	cy	250	2,375,000
Concrete Crest	900	cy	250	225,000
Cement	12,100	tons	100	1,210,000
Joints	5,900	lf	6	35,400
Reinforcement	695	tons	1,000	695,000
Upstream Coffer Dam	23,000	cy	8	184,000
Downstream Coffer Dam	5,600	cy	5	28,000
Dewatering		LS		100,000
Rehabilitate Outlet Works	1	LS		2,600,000
Subtotal				15,054,700
10% Contingency		LS		1,505,500
TOTAL WITH LOW LEVEL OUTLET WORKS BYPASS				**$16,560,200**
Auxiliary Outlet Works (If Built)	1	LS	1,000,000	1,000,000
TOTAL WITH AUXILIARY OUTLET WORKS				**$17,560,200**

Note: LS=lump sum, cy=cubic yards, lf=lineal feet

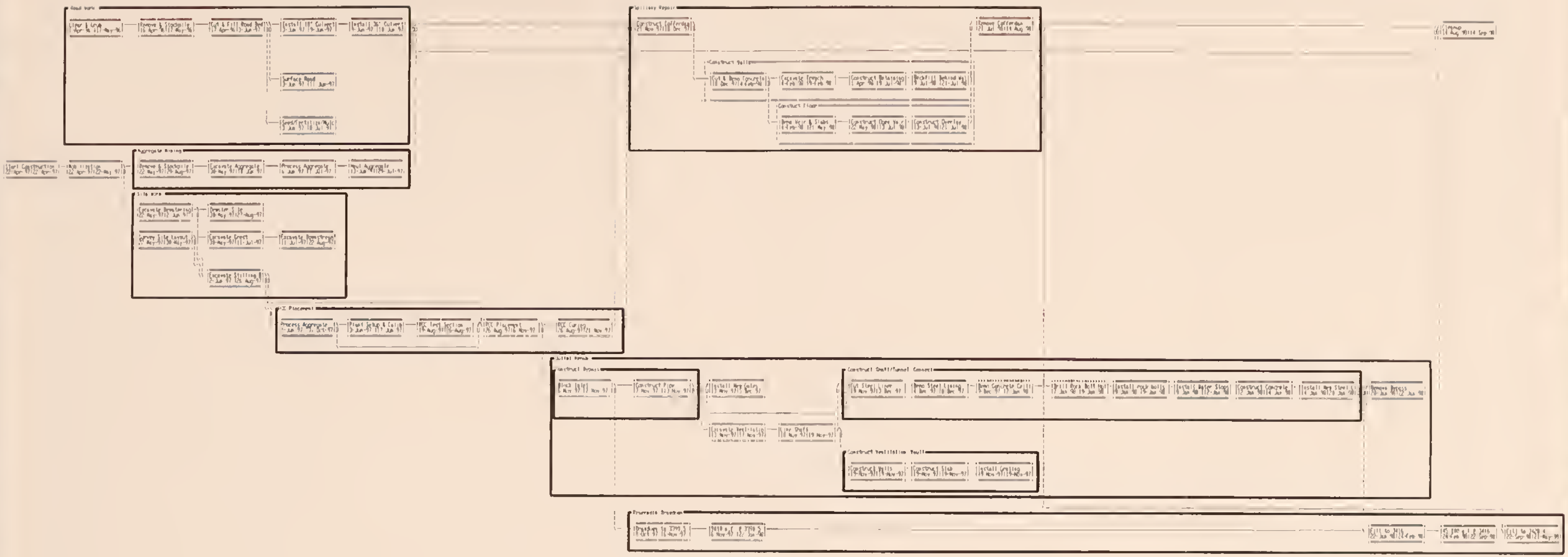
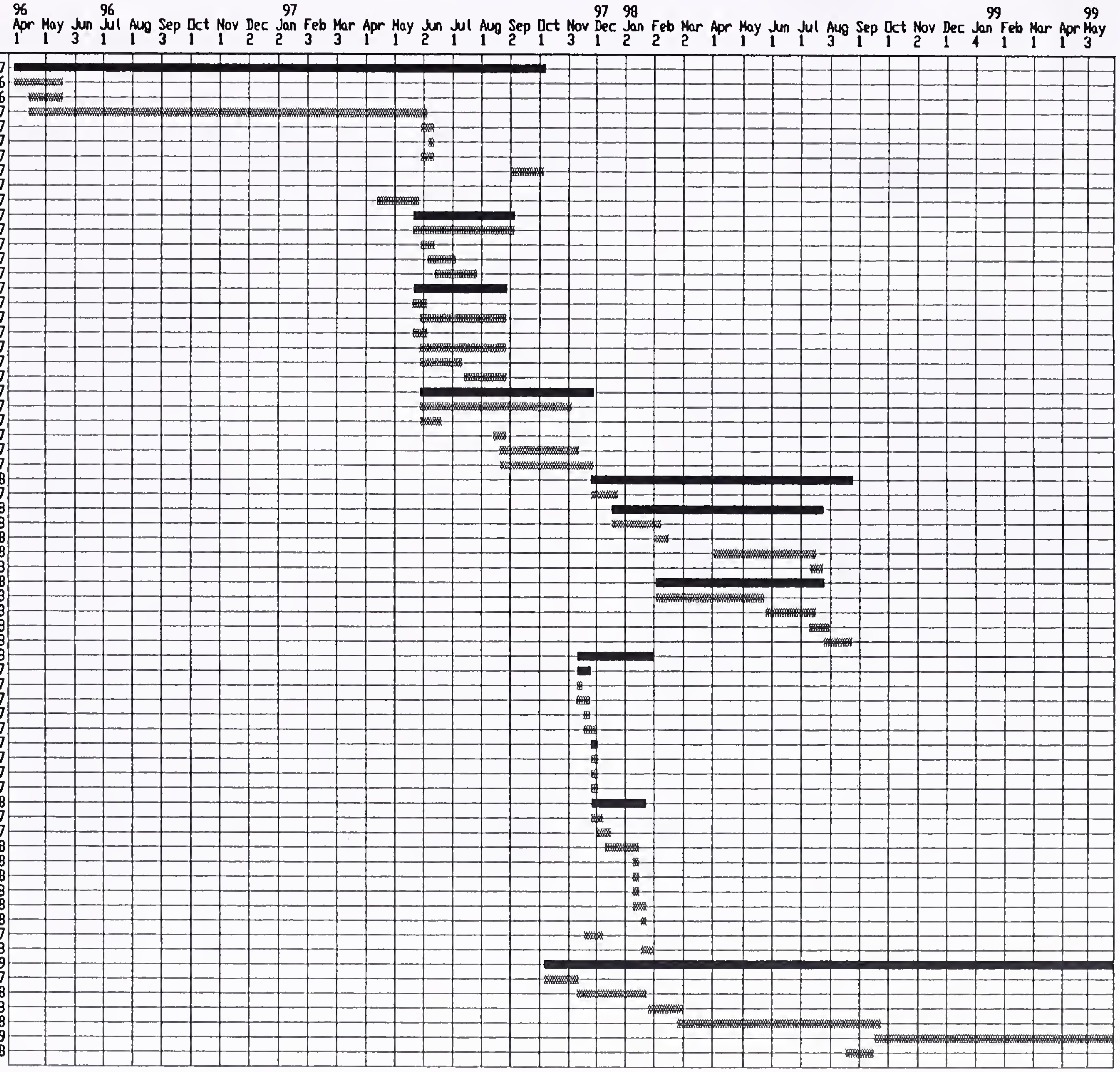


FIGURE 2–18

PROJECT FLOW CHART FOR RCC SPILLWAY

Dependencies ı

Task Name	Start Date	Duration	End Date
Road Work	1-Apr-96	64.2 w	8-Oct-97
Clear & Grub	1-Apr-96	34.6 d	17-May-96
Remove & Stockpile T	16-Apr-96	23.1 d	17-May-96
Cut & Fill Road Bed	17-Apr-96	285.0 d	3-Jun-97
Install 18' Culverts	3-Jun-97	4.1 d	9-Jun-97
Install 36' Culverts	9-Jun-97	0.9 d	10-Jun-97
Surface Road	3-Jun-97	5.6 d	11-Jun-97
Seed/Fertilize/Mulch	3-Sep-97	23.6 d	8-Oct-97
*Start Construction	22-Apr-97	0.0	22-Apr-97
Mobilization	22-Apr-97	22.0 d	22-May-97
Aggregate Mining	22-May-97	13.8 w	29-Aug-97
Remove & Stockpile T	22-May-97	68.9 d	29-Aug-97
Excavate Aggregate	30-May-97	7.1 d	10-Jun-97
Process Aggregate	6-Jun-97	16.6 d	1-Jul-97
Haul Aggregate	13-Jun-97	31.3 d	29-Jul-97
Site Work	22-May-97	13.4 w	27-Aug-97
Excavate Dewatering	22-May-97	5.9 d	2-Jun-97
Dewater Site	30-May-97	62.0 d	27-Aug-97
Survey Site Layout	22-May-97	5.0 d	30-May-97
Excavate Stilling Ba	2-Jun-97	59.9 d	26-Aug-97
Excavate Crest	30-May-97	28.4 d	11-Jul-97
Excavate Downstream	11-Jul-97	30.1 d	22-Aug-97
RCC Placement	2-Jun-97	24.0 w	21-Nov-97
Process Aggregate	2-Jun-97	106.4 d	31-Oct-97
Plant Setup & Calibr	3-Jun-97	10.0 d	17-Jun-97
RCC Test Section	19-Aug-97	5.0 d	26-Aug-97
RCC Placement	26-Aug-97	50.2 d	6-Nov-97
RCC Curing	26-Aug-97	60.0 d	21-Nov-97
Spillway Repair	21-Nov-97	36.5 w	14-Aug-98
Construct Cofferdam	21-Nov-97	17.8 d	18-Dec-97
Construct Walls	18-Dec-97	147.4 d	21-Jul-98
Cut & Demo Concre	18-Dec-97	31.5 d	4-Feb-98
Excavate Trench	4-Feb-98	2.6 d	9-Feb-98
Construct Retaini	1-Apr-98	68.7 d	9-Jul-98
Backfill Behind W	9-Jul-98	8.5 d	21-Jul-98
Constuct Floor	4-Feb-98	115.6 d	21-Jul-98
Demo Weir & Slabs	4-Feb-98	75.2 d	21-May-98
Construct Ogee We	22-May-98	34.2 d	13-Jul-98
Construct Overlay	13-Jul-98	6.1 d	21-Jul-98
Remove Cofferdam	21-Jul-98	17.8 d	14-Aug-98
Outlet Rehab.	6-Nov-97	9.9 w	22-Jan-98
Construct Bypass	6-Nov-97	3.7 d	13-Nov-97
Block Inlet	6-Nov-97	1.0 d	7-Nov-97
Construct Pipe	7-Nov-97	2.7 d	13-Nov-97
Excavate Ventilation	13-Nov-97	2.5 d	17-Nov-97
Line Shaft	18-Nov-97	1.1 d	19-Nov-97
Construct Ventilatio	19-Nov-97	0.5 d	19-Nov-97
Construct Walls	19-Nov-97	0.3 d	19-Nov-97
Construct Slab	19-Nov-97	0.1 d	19-Nov-97
Install Grating	19-Nov-97	0.1 d	19-Nov-97
Construct Shaft/Tunn	19-Nov-97	40.2 d	20-Jan-98
Cut Steel Liner	19-Nov-97	9.9 d	3-Dec-97
Demo Steel Lining	4-Dec-97	3.0 d	8-Dec-97
Demo Concrete Cel	9-Dec-97	19.1 d	7-Jan-98
Drill Rock Bolt H	7-Jan-98	2.0 d	9-Jan-98
Install rock bolt	9-Jan-98	0.8 d	9-Jan-98
Install Water Sto	9-Jan-98	0.5 d	12-Jan-98
Construct Concret	12-Jan-98	2.0 d	14-Jan-98
Install New Steel	14-Jan-98	3.0 d	20-Jan-98
Install New Gates	13-Nov-97	15.0 d	5-Dec-97
Remove Bypass	20-Jan-98	2.0 d	22-Jan-98
Reservoir Drawdown	8-Oct-97	405.0 d	21-May-99
Drawdown to 3390.5	8-Oct-97	20.0 d	6-Nov-97
9000 a.f. @ 3390.5	6-Nov-97	50.0 d	22-Jan-98
Fill to 3416	22-Jan-98	22.0 d	24-Feb-98
45,000 a.f @ 3416	24-Feb-98	147.0 d	22-Sep-98
Fill to 3428.4	22-Sep-98	166.0 d	21-May-99
Cleanup	14-Aug-98	4.0 w	14-Sep-98

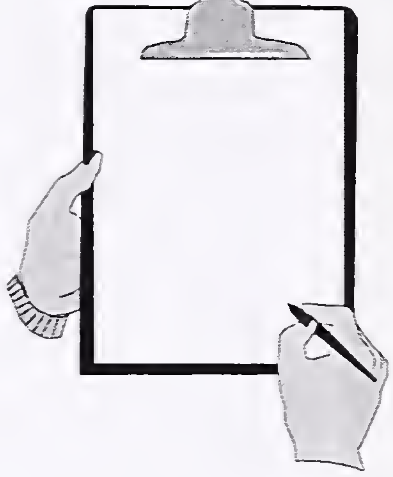


Sub Task
Major Task
Milestone

FIGURE 2–19

PROJECT TIMELINE
FOR RCC SPILLWAY

THIS PAGE INTENTIONALLY LEFT BLANK



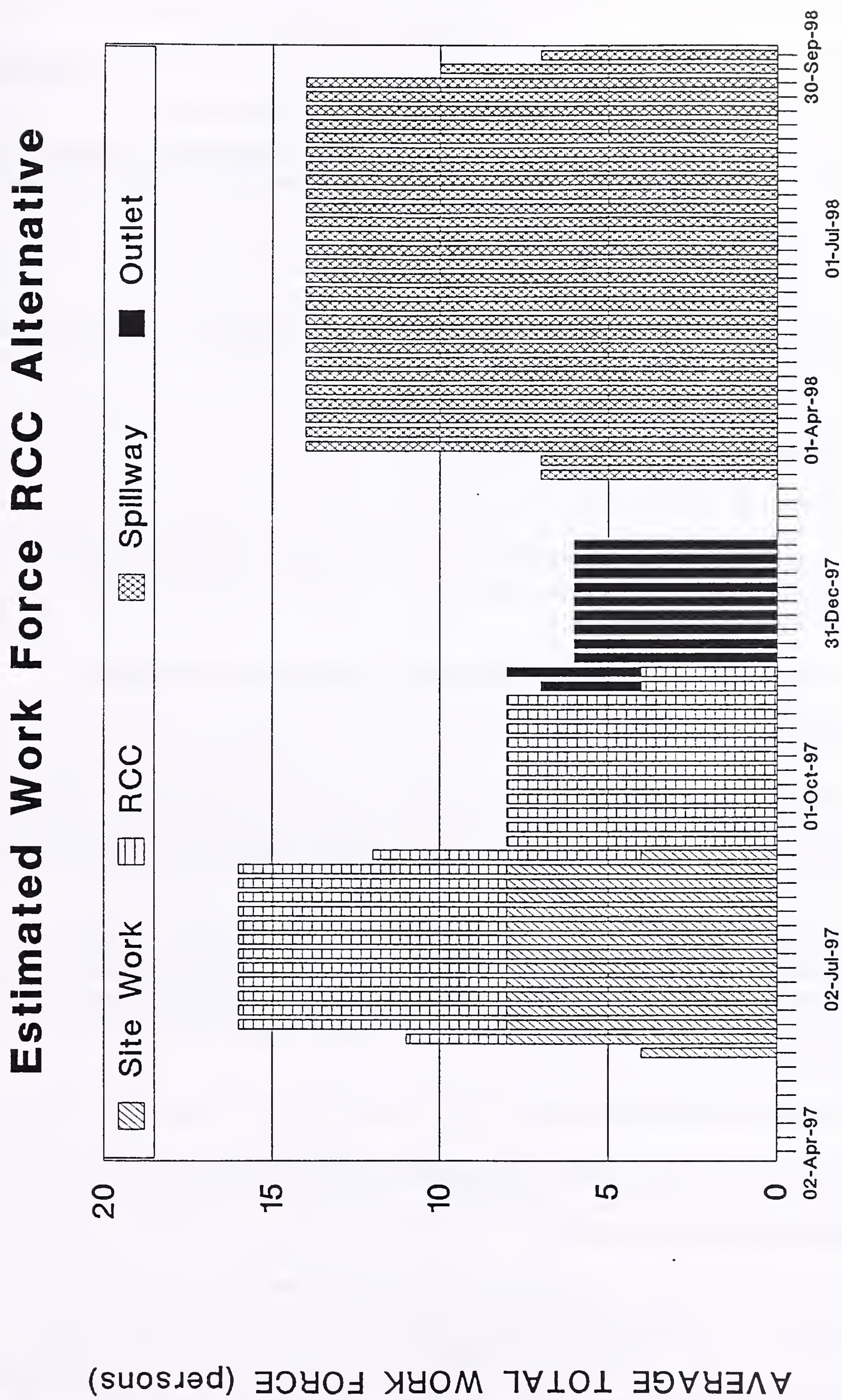


FIGURE 2–20

RCC EMPLOYMENT SCHEDULING

construction activities associated with the overall project such as the county road improvements, structure and shore erosion protection, mitigation, and enhancement. Including other construction-related costs, total cost estimated for this project would be $28 to $31 million.

2.3.16 Land Disturbance

Up to 127 acres would be disturbed if the RCC alternative was implemented including 30 acres for aggregate mining, 56 acres for county and campground roads, 5 acres for rail load-out at Sheridan, and up to 36 acres for the construction staging areas.

2.3.17 Facility Monitoring and Reclamation

2.3.17.1 Construction Staging Area

The construction staging area would be monitored and reclaimed similar to Alternative 1.

2.3.17.2 Aggregate Source Site No. 1

Aggregate source Site No. 1 would be monitored and reclaimed similar to Alternative 1.

2.3.17.3 Aggregate Source Site No. 2

The performance of air and water quality protection features would be monitored during construction operations at this site, involving excavation and RCC aggregate extraction. Special attention would be given to downstream wetlands, cottonwoods, and the historic Lee Homestead structures. Necessary repairs and adjustments would be made immediately with curtailment of relevant operations as required.

A portion of Site No. 2 would be part of the completed dam embankment. A potential exists for additional aggregate mining in the floodplain that would necessitate reclamation. This could include filling and recontouring or development of additional wetland/riparian acreage. Reclamation would be in accordance with a reclamation plan developed during final design that reflected requirements of all permits and relevant environmental regulations.

2.3.17.4 Railroad Unloading Facilities

Monitoring, and reclamation of these facilities would be similar to Alternative 1.

2.3.18 Proposed Mitigations and Monitoring

Proposed mitigations and monitoring would be the same as discussed under Alternative 1.

2.3.19 Fish and Wildlife Habitat Enhancement Features

Proposed fish and wildlife habitat enhancement features would be the same as discussed under Alternative 1.

2.3.20 Alternative 3 No Action

Analysis of Alternative 3, the no-action alternative, is required by the Montana Environmental Policy Act (MEPA) and the National Environmental Policy Act (NEPA). Under this alternative, repairs to Tongue River Dam would not take place. The environmental, social, and economic conditions described in Chapter 3 would not be affected by the construction and operation of the project. Therefore, the no-action alternative provides a baseline for estimating the effects of other alternatives.

The COE has classified the state-owned Tongue River Dam as **unsafe** due to inadequate spillway capacity, and **high hazard** because of the potential for loss of life should the dam fail. DNRC has concerns about the hydraulic and structural adequacy of the spillway even though it has operated the reservoir at a reduced capacity since 1978 (Department of Natural Resources and Conservation 1981, 1991). Loss of the spillway could lead to loss of the dam itself. If the dam should fail, people and property in the Tongue River Valley below the dam would be at risk. Dam failure would also mean loss of valuable irrigation, fish and wildlife, and recreation resources. Satisfaction of water contracts as described in Chapter 3 would no longer be possible. Under the no-action alternative, failure of the spillway and the associated effects are considered likely to occur.

The Northern Cheyenne Tribe currently does not have sufficient water to satisfy the Tribal water right recognized in the Northern Cheyenne-Montana Water Rights Compact. Under the no-action alternative, satisfaction of Tribal water right would not occur, voiding the Compact. In addition, protection of Indian trust assets by the federal government would not occur.

An additional purpose of the project is to provide for the conservation, development and enhancement of fish and wildlife resources and habitat in the Tongue River Basin. Under the no-action alternative, these benefits to wildlife would not occur.

In addition, the impacts of either of the action alternatives would not occur. Status quo would be maintained in the natural environment unless or until the spillway failed, at which time effects would occur. The economic benefits associated with construction employment and increased irrigation water also would not take place (see Chapter 4, Economic Conditions).

2.4 ALTERNATIVES CONSIDERED BUT DISMISSED

A number of alternatives have been determined by the project sponsors to be infeasible, unreasonable, or did not meet the purposes of the project. The alternatives discussed in this section were evaluated and have been dismissed from further consideration. The reasons for dismissal are described in the following sections.

Project sponsor evaluations used as the basis for dismissing these alternatives are contained in *Special Report; Tongue River Dam Rehabilitation* (Northern Cheyenne Tribe, Montana Department of Natural Resources and Conservation, and U.S. Bureau of Reclamation 1992), *Tongue River Dam Study Planning Report and Preliminary Environmental Review* (Bureau of Reclamation 1985), and *The Tongue River Dam Rehabilitation Project* (Department of Natural Resources and Conservation 1981). In addition, a compendium

of all dismissed alternatives and reasons for their dismissal has been compiled and is on file at DNRC entitled *Alternatives Considered but Dismissed from Inclusion in the Tongue River Basin Project Draft EIS.* The following discussion is summarized from that compendium.

2.4.1 Maintaining Current Dam Operations and Purchasing Water for the Settlement Act With the Northern Cheyenne Tribe From Willing Sellers

Under this alternative, the dam would not be repaired. Existing dam operations would continue and water needed to satisfy the Settlement Act with the Tribe would be purchased from Tongue River water users. Potential sellers include holders of Tongue River water rights and water contracts. Ranching operations that sold their water rights or water contracts would have difficulty sustaining their operations. This alternative would temporally provide additional water to the Tribe but would not address repair of the unsafe dam.

This alternative was dropped because it did not satisfy dam safety concerns. Impacts resulting from dam failure would be unacceptable. If the dam failed, this alternative would provide only temporary additional water to the Tribe.

2.4.2 Breaching the Dam and Constructing a New Dam Downstream to Provide Water for the Settlement Act

Under this alternative, the dam would be breached and a new dam constructed on the Tongue River downstream. The new dam would have to be large enough to supply water to satisfy all existing contracts (40,000 acre-feet), and up to an additional 20,000 acre-feet of water to the Tribe as stipulated in the Settlement Act. DNRC has examined a number of other potential dam sites on the river. Of these sites, the Post Creek and High Tongue sites showed the greatest potential.

Because of the high cost of building new dams at either the Post Creek or High Tongue sites, this alternative was dropped. The costs of breaching the existing dam also would be incurred under this alternative. There would be cumulative environmental effects from both construction of a new dam and breaching of the existing dam. Finally, it is uncertain whether either downstream reservoir would store enough water to satisfy the requirements of the Settlement Act.

2.4.3 Breaching the Dam and Purchasing Water for the Settlement Act From Willing Sellers

Under this alternative, the Tongue River Dam would be breached, draining the reservoir and resulting in a loss of water storage. Water for the Settlement Act would be supplied by purchasing Tongue River water rights from willing sellers.

While breaching the dam would eliminate safety concerns, it would also have major adverse environmental, economic, and social impacts. All current project benefits would be lost, including those for irrigation, recreation, fish and wildlife, and flood control.

Though it might be possible to purchase water rights to satisfy a portion of the water committed to the Tribe, without a reservoir it might not be possible to secure enough water. Purchasing water rights would

necessitate the further retirement of irrigated lands outside of the reservation boundaries. For these reasons, this alternative was dismissed from further study.

2.4.4 Draining the Reservoir, Mining the Coal Underneath, Repairing/Enlarging the Dam, Refilling the Reservoir, and Using the Money Generated by the Coal Mining to Pay for the Dam Repair

Under this alternative, the dam would be repaired and raised, but coal deposits underneath the reservoir would be mined before the reservoir was refilled. Money generated by coal mining would be used for dam repair and enlargement costs. It has been estimated that about 47,700,000 tons of recoverable coal could be mined from lands currently submerged by the reservoir (Department of Natural Resources and Conservation 1981).

This alternative would involve mining on an alluvial valley floor. Therefore, certain assurances regarding the maintenance and re-establishment of existing hydrology would have to be demonstrated before a mining permit could be issued. In addition, a large gated spillway would be needed to control reservoir water levels during mining. Building the gated spillway is estimated to increase construction costs substantially. Revenues from water sales would be reduced or lost during the 10 to 20 years required for mining.

The alternative was dismissed because of the excessive amount of time it would take for mining and subsequent dam repair; because during mining, water to downstream users would be severely limited; because the storage component of the Tribal water right could not be satisfied by 1997 as stated in the Water Rights Compact; and finally, because project costs would increase by $77 to $108 million while coal mining would bring in only an additional $9 million.

2.4.5 Repairing the Dam and Developing Additional On-stream Storage to Provide Water for the Settlement Act

Under this alterative, the dam would be repaired and additional water for the Tribe would be supplied by building another dam on the Tongue River downstream. The two dam sites that have been considered are the High Tongue and the Post Creek sites. The alternative also would allow for the coal under the existing reservoir to be mined.

As discussed above, dams at the High Tongue and Post Creek sites would be expensive. Building these dams would also cause substantial new environmental impacts. The Tongue River Dam would still need to be repaired under this alternative. It is unlikely that coal mining the floor of the existing reservoir would be sufficient to offset the comparatively high costs of building a dam at the High Tongue or Post Creek sites.

2.4.6 Repairing the Dam and Developing Off-stream Storage to Provide Water for the Settlement Act

Under this alternative, the dam would be repaired to existing capacity and other off-stream storage facilities would be developed to supply additional water to the Tribe. This alternative would satisfy dam safety concerns.

Off-stream storage was considered in the form of two small reservoirs on Pumpkin Creek (a tributary to the Tongue) and filling abandoned pits at the Decker Coal mines. The additional storage (about 7,600 acre-feet) at Pumpkin Creek would not satisfy the water volume required by the Settlement Act. The coal mine pits were determined to be an unacceptable solution because of concerns about suitable water quality, the legal need to reclaim coal mines and the precedent that this might set, and the inability to store sufficient water (up to 20,000 acre-feet) to meet the Settlement Act. This alternative was dismissed for the reasons discussed above and because off-stream storage options did not prove cost-effective.

2.4.7 Repairing the Dam and Obtaining Water for the Settlement Act From Another Watershed

Under this alternative, the dam would be repaired, and additional water for the Tribe would be imported from another watershed. Stored water from Big Horn Reservoir on the Big Horn River, or Yellowstone River water, would be pumped through a pipeline to the Tongue River.

A pipeline from either source would be about 60 miles long. The pipeline would have to be buried along a corridor, disturbing about 730 acres. This alternative was dropped because the costs of importing water would be prohibitive, especially when added to the costs of repairing the dam. The alternative also may have environmental costs that would exceed those of the other alternatives being considered.

2.4.8 Repairing the Dam and Giving the Tribe a Cash Settlement

Under this alternative, the dam would be repaired to existing capacity. No additional water would be supplied to the Tribe; instead the Tribe would be given a cash settlement.

This alternative would satisfy dam safety concerns because of the dam repair. It was dropped because a cash settlement would not provide the additional storage stipulated in the Settlement Act (up to 20,000 acre-feet).

2.4.9 Repairing the Dam and Obtaining Water for the Settlement Act From Bedrock Aquifers

Under this alternative, the dam would be repaired to existing capacity and bedrock aquifers would be pumped to supply the additional water for the Tribe. Repairing the dam would satisfy dam safety concerns. However, bedrock ground water resources under and in the vicinity of the Northern Cheyenne Indian Reservation were not found to be a viable alternative for satisfying the Settlement Act.

While there is some potential for extracting large amounts of water from local bedrock aquifers, there are also many restrictions. Expected well yields are variable, much of the ground water is marginally suitable or unsuitable for irrigation and human consumption; drilling and pumping costs are high; and pumping these aquifers could reduce surface water flows and regional aquifer levels. For these reasons, this alternative was dismissed.

2.4.10 Repairing the Dam and Obtaining Water for the Settlement Act From Alluvial Ground Water

Under this alternative, the dam would be repaired to existing capacity and additional water for the Tribe would be provided by pumping alluvial ground water from the Tongue River Valley in the vicinity of the reservation.

Storage in the aquifer far exceeds the amount of water moving through it and ground water in the alluvium is connected to the Tongue River. Hence, large withdrawals of ground water would cause the water table to decline. That, in turn, would remove water from the river by diminishing or eliminating baseflow or reducing recharge. A decline in the water table could also cause adverse effects to riparian plant communities along the river. For these reasons the alternative was dropped from further consideration.

2.4.11 Repairing the Dam and Obtaining Water for the Settlement Act by Purchasing Water Rights and Contracts

Under this alternative, the dam would be repaired and the State of Montana through DNRC, would purchase water rights from water users to satisfy requirements of the Settlement Act. The alternative was dropped because no water right holders and so few water contract holders expressed any interest in selling when surveyed by DNRC (Economic Consultants Northwest 1994).

2.5 REASONABLY FORESEEABLE ACTIVITIES

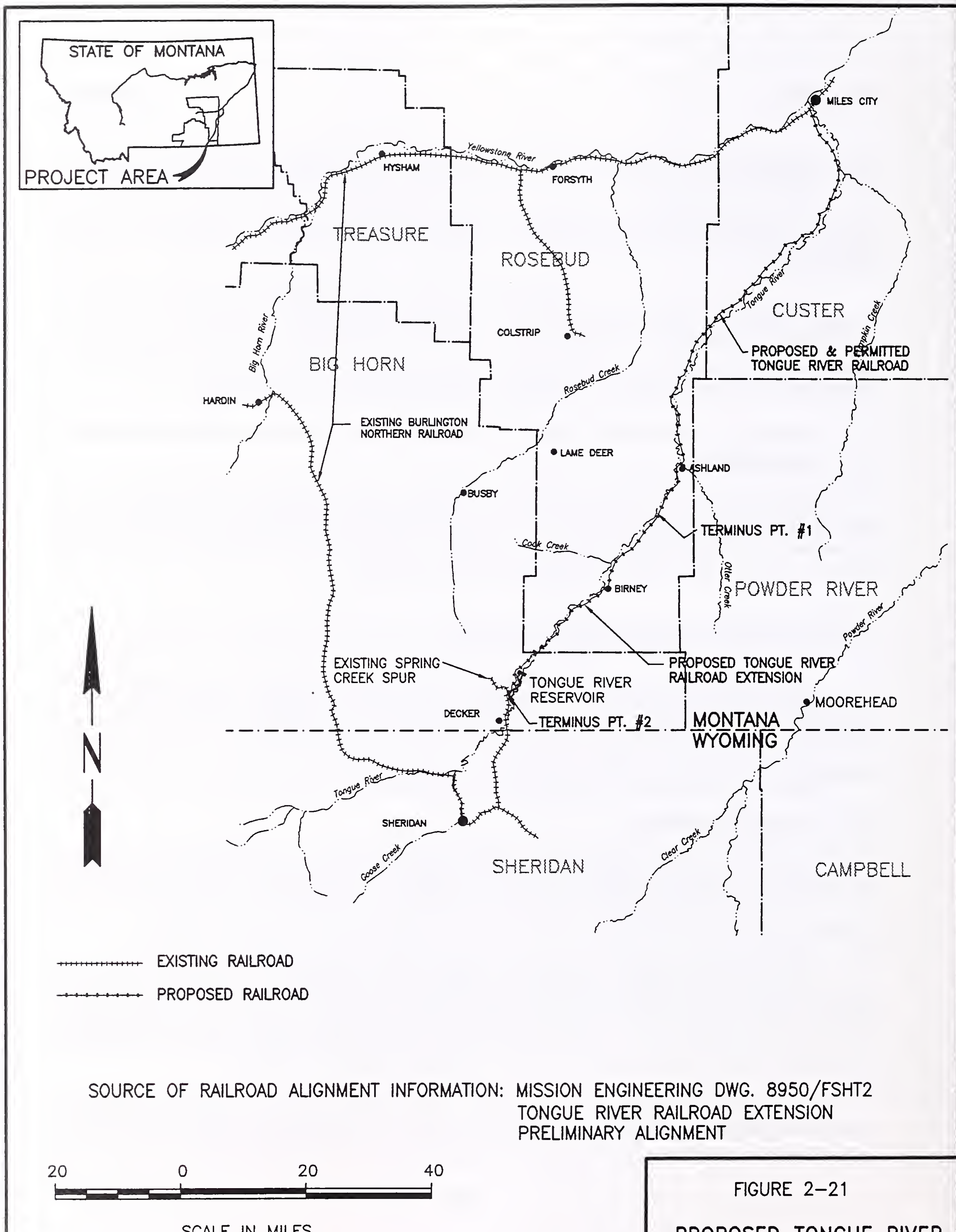
This section discusses reasonably foreseeable activities proposed for location near the project area. Reasonably foreseeable activities are those that have been proposed in specific enough detail to allow evaluation at this time. Evaluation of reasonably foreseeable activities is undertaken to determine whether any of the activities proposed would have an impact on the Tongue River Basin Project or whether there would be significant cumulative impacts when considering the projects together with the Tongue River Basin Project.

2.5.1 Tongue River Railroad

The Tongue River Railroad Company (TRRC) has applied to the Interstate Commerce Commission for authority to construct and operate a 41-mile rail line from a point south of Ashland, Montana, to a connection with operating coal mines near Decker, Montana. The proposed rail line would serve as an extension to TRRC's approved, but yet to be built, 89-mile rail line from Miles City to Ashland.

The preferred alternative route generally would parallel the Tongue River (see **Figure 2-21**). The purpose of the new rail line would be to transport low sulfur, sub-bituminous coal from mines in southeastern Montana and northern Wyoming to electric utilities, primarily in the midwestern states. The line would be single track with a right-of-way averaging 200 feet wide. The alignment would be designed to facilitate the operation of unit coal trains with about 115 cars at a design speed of 40 to 50 MPH.

Depending on its proximity to the Tongue River, construction and operation of the preferred alignment could have significant impacts on the river's aquatic ecology. The most significant impacts to the river are expected to occur along the narrow 10-mile river valley extending from the Tongue River Dam north to the



SOURCE OF RAILROAD ALIGNMENT INFORMATION: MISSION ENGINEERING DWG. 8950/FSHT2
TONGUE RIVER RAILROAD EXTENSION
PRELIMINARY ALIGNMENT

FIGURE 2–21

PROPOSED TONGUE RIVER RAILROAD ALIGNMENT

confluence with Four Mile Creek. Five bridges and a tunnel have been proposed along this 10-mile stretch. This section of river is considered to be the most sensitive and vulnerable to potential negative impacts from the proposed rail line because of topography and important habitat for waterfowl and wildlife.

The area along the proposed route is sparsely populated and dedicated primarily to cattle ranching. Construction and operation of the line would alter the character of the landscape for the duration of the line's operation. Ranchers are concerned that cattle operations may be disrupted, grazing lands bisected, fire hazards increased, noxious weeds introduced, and land productivity and values reduced.

Since much of the right-of-way would be fenced, operation of the line could act as a barrier to wildlife movement. Some access to sport fishing along the river may be lost. Some wetlands may be lost.

Spokespersons for the Tribe have stated that construction and operation of the proposed rail line may permanently disturb or destroy certain aspects of the traditional way of life on the Reservation. Also, the Tribal government has suggested that the rail line would stimulate increased regional coal mining, bringing increasing negative pressures on the Tribe's resources and well-being without guaranteeing any positive benefits.

Although construction and operation of the proposed line may bring increased economic benefits, there may be associated negative social and economic costs, particularly during construction when large, temporary construction crews may strain the area's social and economic resources.

A number of concerns were raised about the structural integrity of Tongue River Dam if blasting was employed to build the rail line. TRRC states that blasting would not be employed if seismic analysis determined that blasting would pose a risk to the dam.

Discussions with staff at the Interstate Commerce Commission indicate that construction of the rail line likely would be delayed by administrative requirements and legal appeals by the public until after the rehabilitation of the Tongue River Dam was completed (Dana White, Interstate Commerce Commission, personal communication, October 31, 1994).

2.5.2 State Highway Improvements

The Montana Department of Transportation (MDT) plans to begin the following three reconstruction projects in the area during 1996-1997:

- Camps Pass - East on U.S. Highway 212 beginning at milepost 76.9 (about 14.8 miles east of Ashland) and extending easterly to milepost 84.7. The estimated construction cost is approximately $9.8 million.
- Lame Deer - East on U.S. Highway 212 beginning at milepost 42.2 (in Lame Deer) and extending easterly to milepost 54.3. The estimated construction cost is approximately $11.5 million.

- Otter - North and South on Secondary Highway 484 beginning at milepost 20.0 (about 20 miles south of U.S. Highway 212) and extending southerly to milepost 27.8. The estimated construction cost is approximately $7.8 million.

2.5.3 Twin Lakes Dam (City of Sheridan, Wyoming)

The information contained in this section is taken from the *Twin Lakes Reservoir Enlargement and Rehabilitation Project Environmental Assessment (1992).* The Sheridan Area Water Supply Joint Powers Board proposes to enlarge and rehabilitate the dam and facilities at Twin Lakes. The Twin Lakes site is about 22 miles southwest of the City of Sheridan, Wyoming, about 50 miles southwest of the proposed project (see **Figure 1-1**).

The Twin Lakes Project would provide an area-wide water supply for the city of Sheridan and surrounding areas. Project components include construction of a treatment plant and distribution system and the enlargement and rehabilitation component. The latter component would consist of constructing a single dam combining Twin Lakes Nos. 1 and 2 reservoirs into a single reservoir. To accomplish this, both dams would be raised and joined.

A construction workforce of about 30 people would be needed in years 1 and 2. The construction workforce is expected to be one-third local hires and two-thirds immigrant workers. A temporary work camp is proposed on National Forest System lands in northwest Wyoming for immigrant workers.

The project has been delayed due to a lack of receipt of a 404 permit from the COE. The permit has been withheld primarily due to remaining concerns about impacts to existing wetlands in the area. As a result, the proposal is currently being modified to reduce the size of the reservoir to contain 3,600 acre-feet of water rather than the 4,600 originally proposed. In addition, some dam embankment redesign would be included.

The project has an estimated cost of $55 million. Because the Twin Lakes project has been delayed indefinitely, it cannot be determined if it would impact the proposed project.

2.5.4 Tie Hack Dam (City of Buffalo, Wyoming)

The city of Buffalo, Wyoming proposes to construct a dam and reservoir on National Forest System lands about 12 miles southwest of Buffalo. Buffalo is about 35 miles southeast of Sheridan, Wyoming and about 65 miles south of Tongue River Dam. The proposed Tie Hack Dam would be located on South Clear Creek about 1,600 feet downstream from the confluence with Sourdough Creek (see **Figure 1-1**). The proposed dam would be constructed of roller-compacted concrete.

The Tie Hack Reservoir would impound 2,425 acre-feet of water and form a reservoir of 63 acres. Arms of the reservoir would extend about 0.5 mile up the valleys of South Clear and Sourdough creeks. The reservoir would supply municipal, fisheries, and hydropower demands (John Almand, U.S. Forest Service, personal communication, February 16, 1995).

The existing access road to the Tie Hack Campground would be inundated by the reservoir. Access to the dam during construction, and to the proposed boat ramp and parking area after completion of the

project, would be via a new road branching from the existing access road about 1,000 feet uphill from the Johnson County Youth Camp.

A boat ramp, parking area, and new campground would be located just west of the dam. The boat ramp would be capable of handling small nonmotorized boats. Fishing, nonmotorized boating, and swimming would be allowed at the reservoir. A new 10-to-20-unit campground would be built for recreational vehicles. All recreational facilities would be administered by the Big Horn National Forest, Buffalo Ranger District.

A 400-square-foot hydropower generation facility would be constructed by the City of Buffalo if the project was built.

A 3-year construction schedule is proposed, most likely beginning in spring 1996 and ending in September, 1998. The construction season is expected to be from June 15 to November 1. Labor requirements would vary for each of the three construction seasons, with the greatest amount of labor needed during the first and second years. About 40 people would be employed during the first year, 40 in the second year, and 20 in the third. Because of the complex nature of constructing an RCC dam, a construction contractor would likely bring its own skilled workers to Buffalo to construct the project. Local subcontractors would likely be used for tasks such as road construction and removal of vegetation in the reservoir pool area. No construction camp is proposed. Nonresident workers would seek housing or trailer sites in Buffalo.

Cost to develop a dam and reservoir at the Tie Hack site is estimated at $10.5 million. Funding would be provided by a grant and loan from the Wyoming Water Development Commission. The loan would be repaid by the City of Buffalo.

2.5.5 Dry Fork Energy Storage Project

A private joint venture proposes to build an energy storage project in the northeastern edge of the Big Horn National Forest in Sheridan County, Wyoming. The project site is about 33 miles northwest of Sheridan, about 40 miles southwest of Tongue River Dam (**see Figure 1-1**).

The purpose of the energy storage project is to supply energy during peak demand periods (Dry Fork Energy Storage Project No date). Water is released from an upper reservoir, usually on top of a mountain, plunges down a shaft, and passes through turbine generators. The electricity generated is then fed into the region's electrical distribution system. The released water is then temporarily stored in a lower reservoir. During off-peak periods, the turbines are reversed to act as pumps, sending the water back to the upper reservoir where it will be ready for use again when the next peak demand occurs. The proposed system can handle as many as 20 peak cycles per day.

Project features include four turbine-generator sets, transformer galleries, a tailrace, and power shaft. This equipment and its installation would be located 0.5 mile below ground surface.

Initially, the upper reservoir would be filled with water from Dry Fork Creek. Thereafter, the plant would operate with a closed-cycle, moving the same water between its upper and lower reservoirs. A total of 1,700 acre-feet per year of water would be required to replace the water lost due to evaporation and seepage.

An EIS will probably begin on this project in 1995. A permit for the project must be obtained from the Federal Energy Regulatory Commission.

The project is estimated to cost $1.2 billion and be built over a 4-year period. Employment is estimated at 250 workers in the first year, and 400 workers in the fourth year. Job preference would be given to local applicants. After project completion, about 50 permanent jobs would be created.

2.5.6 State Park Improvements

DNRC and DFWP propose a program of recreational mitigations at Tongue River State Park during the construction and reclamation phases of the project (see Recreation Mitigation). DFWP proposes to conduct an additional and separately funded program of planned park improvements. These improvements are described below and presented in **Figure 2-12**, along with the mitigations previously discussed under Recreation Mitigation.

1) About 14,400 linear feet of new or relocated roads may be built.

2) A secondary 150-foot by 16-foot boat ramp may be built at PeeWee Point to relieve congestion at Campers Point.

3) A new fish cleaning station may be constructed at Campers Point to accommodate angler use and comply with state and local health codes.

4) One dump station may be constructed at Campers Point to accommodate RV needs and meet state and local health codes.

5) Ten full-service campsites may be developed at Campers Point.

6) About 10,000 square feet of boat trailer storage may be provided at Campers Point to reduce congestion problems at and near the boat ramp and concession building.

7) Three potable water wells may be drilled and maintained -- one each at Rattlesnake, PeeWee, and Sand points.

8) A drip irrigation system may be constructed in the areas where vegetation has been re-established along the new shoreline.

9) About 600 feet of 5-foot wide sidewalk may be developed in primary association with latrines, boating facilities, concession building, and shelters.

10) Six handicapped parking spaces may be developed to serve the park's handicapped guests.

11) Twenty single-post signs may be placed throughout the park facility.

12) Ten double-post signs may be placed throughout the park facility.

13) One sliding dock and one floating dock may be built at Campers Point to accommodate future recreational requirements.

DFWP's park plan improvements may be implemented during the construction and reclamation phases of the project.

2.6 COMPARISON OF ALTERNATIVES

Table 2-7 presents a comparison of impact topic by alternative and resource area for alternatives 1 and 2. **Tables 2-8 and 2-9** provide additional comparisons of alternatives 1 and 2 by project components and construction mileage requirements. Alternative 3 (no action) is not included since impacts would be negligible without the project, except in the case of dam failure.

2.6.1 Summary of Impacts Under the Action Alternatives

Impacts of the two action alternatives, as summarized in **Table 2-7**, are similar with the exception of the following:

- *Hydrology.* Peak outflow under Alternative 1 would increase over existing conditions. There would be no appreciable change in peak discharges from design floods under Alternative 2.
- *Aquatics/Fisheries.* If a bypass were used instead of an auxiliary outlet works under Alternative 2, impacts to aquatics/fisheries would occur during shutdowns for spillway repair. Under this scenario, impacts to aquatics/fisheries could be minor to major and significant depending on the timing and duration of the shutdown.
- *Vegetation.* Increased flood flows associated with Alternative 1 could favor maintenance of downstream riparian communities while Alternative 2 would approximate existing conditions. The excavation of aggregate for construction would destroy up to 60 acres of vegetation under Alternative 1 and up to 30 acres of vegetation under Alternative 2.
- *Aggregate Material Sources.* Alternative 1 would require the mining of aggregate at Site No. 1 while Alternative 2 would require sites 1 and 2 to be mined.
- *Construction Employment.* Employment required during the construction of Alternative 1 would be slightly higher than for Alternative 2. Wages and salaries are estimated at $1.9 million for Alternative 1 and $1.7 million for Alternative 2.
- *Appearance.* Alternative 1 would differ in appearance from the existing spillway due to its zigzag crest. Alternative 2 would have a different dam embankment profile than the existing dam due to the secondary and emergency spillways.
- *Project Cost.* Alternative 1 is estimated to have a cost 50 percent greater than Alternative 2.

TABLE 2-7
Comparison of Impacts by Action Alternative and Resource[2]

IMPACT TOPIC	ALTERNATIVE 1 (Labyrinth Weir)	ALTERNATIVE 2 (RCC)
CLIMATE		
Impacts on the climate of the area from project construction and operation	Negligible in the short and long terms	Same as Alternative 1
AIR QUALITY		
Impacts on air quality from project construction and operation	Negligible to minor in the short term and negligible in the long term	Same as Alternative 1
GEOLOGY		
Impacts on reservoir capacity, dam integrity, and human health and safety	Negligible to minor in the short and long terms	Same as Alternative 1
GEOTECHNICAL STABILITY		
Impacts on factors of safety relating to the dam embankment	Negligible in the short and long terms	Same as Alternative 1
SOILS		
Impacts to shoreline soils from higher water levels in the reservoir	Minor to moderate over the short term and negligible over the long term	Same as Alternative 1
Impacts to prime and unique agricultural land from higher water levels in the reservoir	Minor in the short and long terms	Same as Alternative 1
Impacts to soil productivity in project-related surface disturbance areas	Moderate to major over the short term and minor over the long term	Same as Alternative 1
Impacts on soils from relocation of the State Park	Minor in the short and long terms	Same as Alternative 1
HYDROLOGY		
Impacts on reservoir elevations and storage from proposed reservoir operations	Major and significant in the short term and major, beneficial and significant in the long term	Same as Alternative 1
Short-term impacts to downstream releases during construction	Minor to moderate in the short term	Same as Alternative 1

[2] Qualitative terms are used to describe anticipated magnitude of impacts and, where appropriate, anticipated importance of impacts to the human environment. The terms "major", "moderate", "minor", and "negligible" describe magnitude. "Significant", "potential to become significant", and "insignificant" describe importance. Impacts are assumed to be insignificant unless otherwise identified.

TABLE 2-7 (Cont.)

IMPACT TOPIC	ALTERNATIVE 1 (Labyrinth Weir)	ALTERNATIVE 2 (RCC)
HYDROLOGY (Continued)		
Long-term impacts to downstream releases following construction	Negligible to minor in the long term	Same as Alternative 1
Impacts on reservoir ice from increased reservoir water levels	Negligible to minor in the short and long terms	Same as Alternative 1
Impacts on upstream river ice from increased reservoir water levels	Minor to moderate in the short term and minor in the long term	Same as Alternative 1
Short-term impacts on coal mine pits from decreased reservoir water levels during construction	Minor to moderate in the short term	Same as Alternative 1
Long-term impacts on coal mine pits from increased reservoir water levels	Negligible in the long term	Same as Alternative 1
Impacts of increased mine pit discharges on reservoir and downstream water quality	Negligible in the short and long terms	Same as Alternative 1
Short-term impacts on shallow ground water from decreased in-stream flows during construction	Negligible to minor in the short term	Same as Alternative 1
Long-term impacts to ground water from increased reservoir water levels	Negligible in the long term	Same as Alternative 1
Impacts to ground water quality from increased reservoir water levels	Minor in the short term and negligible in the long term	Same as Alternative 1
Short-term impacts to reservoir and downstream water quality from construction	Minor to moderate in the short term	Same as Alternative 1
Downstream impacts of the 100-year flood event Note: Dam Failure would result in impacts moderate to major and significant in the short and long terms	Moderate to major and significant in the short and long terms	Negligible in the short and long terms
WETLANDS		
Impacts on wetland acreage from increased inundation	Negligible in the short and long terms	Same as Alternative 1

TABLE 2-7 (Cont.)

IMPACT TOPIC	ALTERNATIVE 1 (Labyrinth Weir)	ALTERNATIVE 2 (RCC)
AQUATICS/FISHERIES		
Impacts of construction-related drawdown and reduced pool capacity on reservoir fisheries	Minor to moderate in the short term and negligible to minor in the long term with the potential to become major and significant	Same as Alternative 1
Impacts of reduced downstream releases during construction on river aquatic life	Minor in the lower reach of the river and minor to moderate immediately below the dam in the short term	Same as Alternative 1, except if a bypass were used during rehabilitation of the outlet works, impacts immediately below the dam would be major with the potential to become significant in the short and long terms.
Long-term impacts of postconstruction reservoir operations on reservoir and downstream aquatic life	Minor to moderate and beneficial in the long term	Same as Alternative 1
WILDLIFE		
Impacts on terrestrial wildlife from increased reservoir water levels	Moderate to major and significant in the short term and minor in the long term	Same as Alternative 1
Impacts on water fowl from increased reservoir water levels	Minor in the short term and negligible in the long term	Same as Alternative 1
Impacts on threatened and endangered species from increased reservoir water levels	See Appendix B	See Appendix B
VEGETATION		
Impacts on vegetation from increased reservoir water levels	Moderate in the short and long terms	Same as Alternative 1
Impacts on vegetation from project-related road construction	Minor in the short and long terms, but if weeds became established, major in the short and long terms	Same as Alternative 1
Impacts on vegetation from state park relocation	Minor in the short and long terms, but if weeds became established, major in the long term	Same as Alternative 1
Impacts on vegetation at the construction staging area	Major in the short term and minor in the long term	Same as Alternative 1

TABLE 2-7 (Cont.)

IMPACT TOPIC	ALTERNATIVE 1 (Labyrinth Weir)	ALTERNATIVE 2 (RCC)
VEGETATION (Continued)		
Impacts on ethnobotanical resources from project activities	Negligible in the short and long terms	Same as Alternative 1
Impacts on downstream and aggregate source sites nos. 1 and 2 vegetation associated with project construction and operation	Minor in the short and long terms	Same as Alternative 1
BIODIVERSITY		
Impacts of construction on biological diversity from habitat alteration	Minor in the short term and minor to moderate and beneficial in the long term	Same as Alternative 1
SOCIAL CONDITIONS		
Impacts on social conditions from project construction and operations	Minor adverse and beneficial in the short term and negligible in the long term	Same as Alternative 1
Note: Dam Failure would result in moderate to major and significant impacts in the short and long terms		
ECONOMIC CONDITIONS		
Impacts on employment and personal income from project construction and operation	Minor to moderate and beneficial in the short term and minor in the long term	Same as Alternative 1
Impacts on the agricultural economy from project construction and operation	Minor in the short and long terms	Same as Alternative 1
Impacts on area coal mining from project construction and operations	Negligible in the short and long terms	Same as Alternative 1
Impacts on public sector fiscal conditions from project construction and operations	Minor in the short term on local government. Significant in the short term on state and federal governments, and potentially significant and beneficial in the long term	Same as Alternative 1
Note: Dam Failure would result in moderate to major and significant impacts in the short and long terms		

TABLE 2-7 (Cont.)

IMPACT TOPIC	ALTERNATIVE 1 (Labyrinth Weir)	ALTERNATIVE 2 (RCC)
TRANSPORTATION		
Impacts on local roads from project construction and operations	Moderate in the short term and negligible in the long term	Same as Alternative 1
Impacts on secondary highways from project construction and operations	Minor in the short term and negligible in the long term	Same as Alternative 1
Impacts on off-road travel from project construction and operation	Negligible to minor in the short and long terms	Same as Alternative 1
Impacts to railroads from project construction and operation	Minor in the short term and negligible in the long term	Same as Alternative 1
Note: Dam failure would result in major and significant impacts in the short and long terms	Note: If a load-out at Sheridan were used, impacts would be moderate in the short term and negligible in the long term	Note: If a load-out at Sheridan were used, impacts would be moderate in the short term and negligible in the long term
RECREATION		
Impacts to state park access from project construction and operation	Moderate to major in the short term and negligible in the long term	Same as Alternative 1
Long-term impacts to state park recreation opportunity from project activities	Negligible to minor and beneficial in the long term	Same as Alternative 1
Impacts to downstream floating and fishing from project construction and operation	Negligible to minor in the short and long terms	Same as Alternative 1
Impacts to recreation experience from project construction and operation	Moderate to major in the short term and negligible to minor in the long term	Same as Alternative 1
Short-term impacts to boating opportunities and navigational safety from construction drawdown	Moderate in the short term and minor to moderate in the long term	Same as Alternative 1
Note: Dam Failure would result in moderate to major and significant impacts in the short and long terms		
LAND USE AND OWNERSHIP		
Impacts to land use and ownership from project construction and operation	Minor in the short and long terms	Same as Alternative 1

TABLE 2-7 (Cont.)

IMPACT TOPIC	ALTERNATIVE 1 (Labyrinth Weir)	ALTERNATIVE 2 (RCC)
CULTURAL RESOURCES		
Impacts on cultural resources from project construction and operation	Moderate in the short and long terms	Same as Alternative 1
NOISE		
Impacts on road and highway noise levels from construction activity	Minor in the short term	Same as Alternative 1
Impacts on the noise levels in the construction staging area from construction activity	Minor in the short term	Same as Alternative 1
Impacts to Tongue River State Park noise levels from construction activity	Minor in the short term	Same as Alternative 1
If a rail load-out at Sheridan were used, impacts on a three-to-four block area from construction	Moderate in the short term and negligible in the long term	Same as Alternative 1
Impacts on Decker, Montana	Minor in the short term and negligible in the long term	Same as Alternative 1
VISUAL RESOURCES		
Impact on visual resources from project construction and operation	Moderate in the short term and negligible in the long term	Same as Alternative 1
Impacts to appearance of the spillway	Negligible in the short and long terms	Minor in the short and long terms

2.6.2 Alternative 3 (No Action)

Except in the case of dam failure, the selection of Alternative 3 would result in negligible impacts for all topics and resource areas. Under Alternative 3, the dam would continue to have an unacceptable risk of failure. Dam failure would result in moderate to major and significant impacts to hydrology, social and economic conditions, and recreation. Dam failure would pose a threat to human life, and property. Economic losses from dam failure are estimated at $300-$500 million dollars (PRC Engineering 1986) and resulting damage to fish and wildlife habitat could take up to 40 years to fully recover (U.S. Bureau of Reclamation 1985).

TABLE 2-8
Comparison of Project Components by Alternative

	ALTERNATIVE 1 (Labyrinth Weir)	ALTERNATIVE 2 (RCC)
Spillway design flood outflow, cfs	100,000	100,000
Maximum reservoir elevation, feet	3,428.4	3,428.4
Maximum reservoir storage, acre-feet	80,000	80,000
Maximum reservoir storage during construction, acre-feet[1]	35,000	45,000
Minimum reservoir storage during construction, acre-feet	9,000	9,000
Coffer dams upstream and downstream	yes	yes
Auxiliary low level outlet works	yes	no[2]
New Inundation, acres	400	400
Peak 100-year flood outflow, cfs	18,928	11,135
Average downstream floodplain width, feet	487	387
Average downstream floodplain depth, feet	13.5	10.8
Aggregate Site No. 1 disturbed acres (max)	60	20
Aggregate Site No. 2 disturbed acres (max)	0	10
Staging area disturbed acres (max)	36	36
County Road No. 380 disturbed, miles	8.5	8.5
County Road No. 380 shutdown during construction, miles	1.5	1.5
Tongue River State Park relocated	yes	yes
Tongue River Canyon fishing access site disturbed during construction	yes	yes
Coal mine mitigation required	yes	yes
Structure and shore erosion protection required	yes	yes
Peak employment, persons	26	16
Construction cost, million $	27	17[3]/18[4]

Note: [1] Depending on inflows to the reservoir and other safety considerations
[2] Subject to Record of Decision (ROD)
[3] Construction cost for RCC spillway without an auxiliary low level outlet works
[4] Construction cost for RCC spillway with an auxiliary low level outlet works

TABLE 2-9
Comparison of Materials and Mileage Requirements for Action Alternatives

ALTERNATIVE 1 (LABYRINTH WEIR)/ALTERNATIVE 2 (RCC)[1]						
TASK	CUBIC YARDS	TONS	TRIPS	MI/TRIP	OFF-ROAD MILES	HIGHWAY MILES
COUNTY ROAD CONSTRUCTION						
Aggregate from Site No. 1	19,000	35,150	950	4.82	4,579	no
SPILLWAY CONSTRUCTION						
Coffer dams	28,600	52,910	1,430	0.8	1,144	no
Excavation of foundation materials	660,000/ 340,000	1,221,000/ 629,000	33,000[2]/ 17,000[2]	0.8	26,400/ 13,600	no
Disposal of existing spillway	6,200	11,470	620	0.8	496	no
Structural aggregate from Site No. 1	30,600/ 14,300	56,610/ 26,455	1,530/ 715	9.64	14,749/ 6,893	no
RCC aggregate from Site No. 1 for base	61,000	112,850	3,050	9.64	29,402	no
Haul mixed RCC aggregate	61,000	112,850	3,050	0.4	1,220	no
Cement		15,400	770	17	13,090	yes
Reinforcing steel		2,300	115	17	1,955	yes
OUTLET CONSTRUCTION						
Structural aggregate from Site No. 2	1,320	2,442	66	9.64	636	no
Cement		515	26	17	438	yes
Reinforcing steel		137	9	17	155	yes
Mixed Concrete from staging to placement	1,320	2,442	220	0.4	88	no
STRUCTURE AND SHORE EROSION PROTECTION						
Haul and place riprap	91,000	168,350	9,100	4.82[3]	43,862	yes
TOTALS			53,936		138,214	

Note: [1] Requirements between alternatives are the same except where differences are separated by a "/" between entries
[2] Short, internal haul trips
[3] Assumes riprap is unloaded at Decker Coal Mine facilities

Source: Morrison-Maierle 1994; DNRC materials estimate 1994.

CHAPTER 3 EXISTING ENVIRONMENT

3.1 INTRODUCTION

This chapter describes the existing environment of the area that could be affected by the action alternatives. The next chapter analyzes the impacts on the environment by alternative.

3.2 CLIMATE

The temperature and precipitation characteristics of the Tongue River Basin are typical of a semi-arid climate. The region experiences cool, moist springs, warm, dry summers, and cold, moist winters. Winters are influenced by high pressure, arctic cold air masses from Canada, and by moist air masses from the northern Pacific region. Spring and summer precipitation usually is the result of moist air from the Gulf of Mexico flowing northward and being cooled as it rises across the High Plains.

Precipitation in the region varies considerably from month to month. Mean annual precipitation ranges from approximately 12 inches at the lower elevations (at the dam) to 15 to 16 inches at higher elevations (surrounding hills). About one-half of annual precipitation occurs during the period from April to June. A large portion of this precipitation occurs as thunderstorms. Precipitation data collected from the region have shown late spring and early summer as the wettest period and late summer as the driest period.

Large annual temperature variations are experienced in the region. The mean annual temperature in the region is about 45° Fahrenheit (F). The minimum and maximum temperatures recorded at the Montco meteorological station (about 35 miles northeast of the dam) were -22°F and 102.2°F, respectively.

Winds in the region tend to blow from the northwest in the autumn and winter, from the west in the spring, and from the southwest in the summer. Near the Tongue River, winds are influenced by the orientation of the Tongue River Valley. Wind speeds are generally moderate, averaging approximately 6 miles per hour. However, during the passage of weather systems or near thunderstorms, wind speeds can be considerably higher. There are large diurnal (daily) and seasonal changes in mixing heights in the Tongue River region. Mixing height is the above-ground elevation where all air quality constituents are thoroughly mixed. Mixing heights generally are lower in the mornings and much higher in the afternoons. The morning mixing heights increase slightly in the spring, whereas the afternoon mixing heights are lowest in winter and considerably higher in spring and summer. This is an important factor in determining pollutant dispersion rates (Interstate Commerce Commission 1992).

3.3 AIR QUALITY

Air quality conditions in the Tongue River Basin are generally considered good. Higher than normal air pollutant concentrations have occurred around existing coal mines and populated areas. With the exception of Lame Deer, air pollutant levels are well within Montana and federal ambient air quality standards. On August 7, 1987, Lame Deer was designated as a Group I area for PM-10; indicating the area as having the

potential to exceed the PM-10 standards. (Total Suspended Particulates [TSP] standards were replaced in 1987 by a standard measuring the 10 micron or smaller suspended particulates [PM-10]). Chemical mass balance of the Lame Deer area indicated airborne road dust as the primary cause of noncompliance with the PM-10 ambient standards.

The remainder of the Tongue River Basin has been designated either as attaining the ambient standards or as non-classified. Background PM-10 measurements made during 1992-93 at the Spring Creek coal mine (about 5 miles west of the project area) have shown an average concentration of 13 micrograms per cubic meter (ug/m^3), as compared to the Montana and federal standard of 50 ug^3/m **(see Appendix D)**. The maximum PM-10 concentration measured during the 1992-93 period at the Spring Creek background site was 42 ug/m^3, as compared to the Montana and federal standard of 150 ug/m^3.

The majority of the Tongue River Basin is classified as Class II under the federal Prevention of Significant Deterioration (PSD) regulations, allowing for moderate deterioration **(see Appendix D)**. The exception is the Class I designation on the Northern Cheyenne Indian Reservation. The Class I designation restricts increases in ambient air pollutant levels to a much smaller increment than the Class II designation.

Existing sources for air pollutants in the Tongue River Basin include various coal strip mines, agricultural operations, wood waste burning and home heating, vehicle traffic on unpaved roads, and wind erosion from exposed areas. Heavy equipment at the coal strip mines are significant sources for gaseous pollutants including sulfur dioxide, nitrogen dioxide, volatile organic compounds, and carbon monoxide. All of the existing sources listed above are sources of TSP and PM-10.

Wind erosion of exposed areas includes roads, summer fallow fields, dry land pastures, exposed areas within the coal strip mines, and the exposed beaches of the Tongue River Reservoir. Some beaches contain silt material washed into the reservoir from precipitation runoff. The silt material is composed of fine particulates that, when exposed to the sun and wind, can dry out and become airborne. Generally these particulates become airborne only during high winds. Once winds diminish or precipitation occurs, wind erosion ceases.

3.4 GEOLOGY

Tongue River and Tongue River Reservoir lie within that portion of the Northern Powder River Basin defined by sedimentary formations deposited during the later portion of the Tertiary period. The Wasatch and Fort Union formations include the sandstones, siltstones, shales, and coal beds that define the area. The Fort Union Formation is divided among the Tongue River, Lebo Shale, and Tullock Members with the Tongue River Member being the predominant unit in the basin.

Dissected terrain, underlain by discontinuous sandstones, siltstones, shales, and coal seams, is found in the Tongue River area and throughout eastern Montana. Geologic structure underlying the project is characterized by a northwest-plunging syncline, or fold in rock layers where the layers dip inward towards an axis. Natural processes of weathering, erosion and sloughing have caused slope failures and rock slides in the vicinity of the reservoir in parts of sections 13, 24 and 25, T8S, and R40E. The Tongue River Dam

is located in an area of low seismic risk, having a Unified Building Code classification of one (International Conference of Building Officials 1991).

3.4.1 Mineral Resources

Coal seams of varying thicknesses exist in the vicinity of the Tongue River Reservoir and upstream and downstream in the Tongue River Valley. Locally, some exposed coal seams have burned as a result of natural causes, baking overlying sandstones and shales into a rock called clinker. Recoverable coal reserves under the south end of the reservoir and beneath the valley about 7 miles downstream were estimated to be 128.9 million tons in 1981 (Montana Department of Natural Resources and Conservation 1981). The Decker Coal Company currently operates coal strip mines adjacent to the Tongue River Reservoir.

Gravel resources can be found in the vicinity of the Tongue River Reservoir. Two sites are discussed in Chapter 2 under the description of alternatives. No known oil and gas resources are recorded in the project area.

3.5 GEOTECHNICAL STABILITY

Geotechnical information was derived from the construction drawings of the dam, previous experience with the dam, and postconstruction records. In 1967, Bechtel Corporation carried out an exploration program that consisted of seven borings (four in the embankment, one on the right abutment, one on the left abutment, and one near the spillway crest), and surficial mapping of the Tongue River Dam and immediate vicinity (Bechtel Corporation 1969). A laboratory test program was conducted on undisturbed soil samples recovered during drilling and consisted of classification, strength, permeability, and consolidation tests.

3.5.1 Dam Embankment

The existing Tongue River Dam is 91 feet high, 1,824 feet long, with a crest width of 54.5 feet at elevation 3,442.4 feet. The upstream slope is 1V (vertical) on 3H (horizontal) with a 33-foot ± wide berm at elevation 3,384.4 feet. The downstream slope is 1V on 2.25H. Waste material is stockpiled at the toe to elevation 3,392.4 feet **(see Figure 2-15)**. The stockpiled material has a 40-foot wide berm at elevation 3,392.4 feet and a 60-foot wide berm at elevation 3,384.4 feet.

The upstream face of the dam consists of a layer of waste scoria and sandstone. Borings in 1967 indicated the core of the dam is impervious clay. The middle section downstream of the centerline of the dam consists mostly of sand and gravel. The downstream shell consists of sand, gravel, and scoria.

The materials borrow source is located just upstream of the dam. It does not appear that borrow areas downstream of the dam were developed. Material from excavation required to construct the spillway, embankment foundation, and outlet works was probably used in the embankment, particularly the sand, gravel and scoria. The balance of the excavation was deposited in a waste area below the dam. Data are collected routinely and used to evaluate the condition of the dam embankment.

3.5.2 Foundation Conditions, Seepage, and Drainage

The foundation of the Tongue River Dam embankment as indicated on the 1967 boring logs (Bechtel Corporation 1969) is generally a 50- to 60-foot thick alluvial deposit of medium dense to very dense silts, sands, and gravels that overlies relatively impervious sandstone and siltstone bedrock. Construction drawings show a cutoff trench beneath the impervious section carried to bedrock and a toe drain placed beneath the downstream shell at a depth of about 11 feet below the adjacent foundation.

Past inspections of the downstream face and toe areas have indicated no evidence of seepage exiting from the face of the dam. A marshy area was noted some 500 feet downstream of the toe and is probably caused by seepage through the foundation. A small flow appears in the old river meander channel at the right toe of the dam and reportedly exits from the embankment drain near the toe of the dam. Another minor seep has been located in the first side canyon some 500 to 800 feet downstream from the toe of the dam in the right abutment. This seep currently is being monitored by DNRC. An additional seep has been located in the left abutment of the dam immediately downstream of the existing spillway. This seep, however, had insufficient flows for monitoring during 1994.

3.5.3 Stability

Geotechnical stability of dam embankments generally is measured by factors of safety. A factor of safety in excess of minimum standards is presumed to be safe. Preliminary stability analyses completed by DNRC, January 1, 1994, indicate that the embankment meets or exceeds current stability criteria shown in **Table 3-1.**

TABLE 3-1
Existing Dam Embankment Stability

LOADING CONDITION	EXISTING FACTOR OF SAFETY	MINIMUM ACCEPTABLE FACTOR OF SAFETY
Steady-state seepage Downstream face	2.1	1.5
Steady-state seepage Upstream face	2.1	1.5
Seismic with 0.02g acceleration	2.0	1.1
Rapid Drawdown	2.2	1.3

Source: Department of Natural Resources and Conservation 1994.

3.6 SOILS

Soils in the reservoir area are predominantly loams, silty clay loams and silty clays with occasional cobbles and outcrops as inclusions. Numerous loams dominated by the deep, well-drained Haverson Series, and Complexes of the Wibaux series, characterize the reservoir perimeter. The steep ridges and drainageways are characterized by gravelly and cobbly soils and terrace escarpments.

The proposed construction staging area would be located in predominantly gravelly loams of the Clapper-Harvey Complex and loams of the Wibaux Series and Wibaux-Spearman Complex. These units have moderate erosion potential, low shrink-swell potential, and have low corrosivity to concrete. The river floodplain in the vicinity of the construction staging area is characterized by undifferentiated Haverson and Glenberg and Haverson and Lohmiller soils that are frequently flooded.

Various mapping units of the Glenberg, Busby, Havre, Yamac, and Haverson series may be designated prime farmland, if irrigated. Soils of the Glenberg and Haverson series designated as "prime if irrigated" farmland are in scattered locations around the reservoir and are the predominant soils adjacent to the river upstream of the reservoir. There have been no soils of "unique" farmland quality designated in the areas proposed for project activities.

No soils in the immediate study area have been designated as land of "statewide importance". This designation is made by local conservation districts and identifies soils with production potential equal to those of "prime farmland". The mapping units of Cooers loam, Harlem silty clay loam, Kobar silty clay loam, and Yamac loam 2 to 8 percent slopes are located downstream of the reservoir and are considered to be farmland of "statewide importance".

3.7 HYDROLOGY

3.7.1 Surface Water Resources

The Tongue River Basin, including the Tongue River and its tributaries, is the study area for hydrology. The headwaters of the Tongue River are in the Big Horn Mountains of Wyoming. The river flows in a northeasterly direction for approximately 300 miles to its confluence with the Yellowstone River at Miles City, Montana. The Tongue River Dam (**see Figure 1-1**) is located approximately 10 miles downstream of the Montana-Wyoming state line. The multi-purpose reservoir and dam provide water for irrigation, recreation opportunities, and flood protection.

Flows in the Tongue River average 444 cubic feet per second (cfs) as gauged just below the dam and 420 cfs at Miles City, Montana (U.S. Geological Survey 1992). Based on 31 years of record, the average annual discharge of the Tongue River just below the dam is 321,500 acre-feet and 304,300 acre-feet at Miles City, Montana (U.S. Geological Survey 1992). Flows at Miles City are lower than dam releases during the May-to-September period when approximately 15,000 acres in the basin are irrigated (Northern Cheyenne Tribe, Montana Department of Natural Resources and Conservation, and U.S. Bureau of Reclamation 1992) (**see figures 3-1 and 3-2**). Flows from October to April are higher at Miles City than dam releases as a result of contributions from river tributaries and absence of irrigation withdrawals (Montana Reserved Water Rights

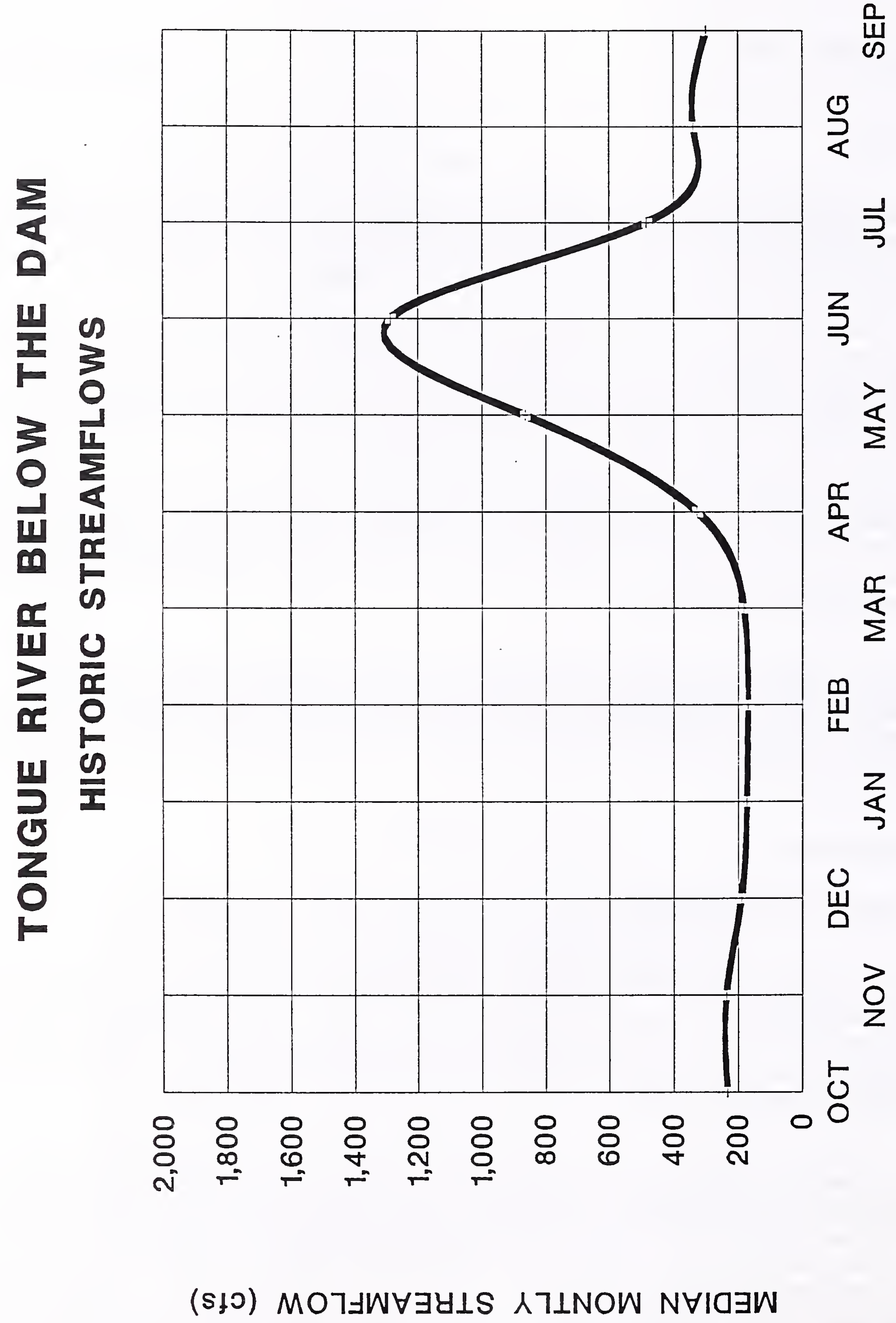


FIGURE 3–1

HISTORIC TONGUE RIVER FLOWS JUST BELOW DAM

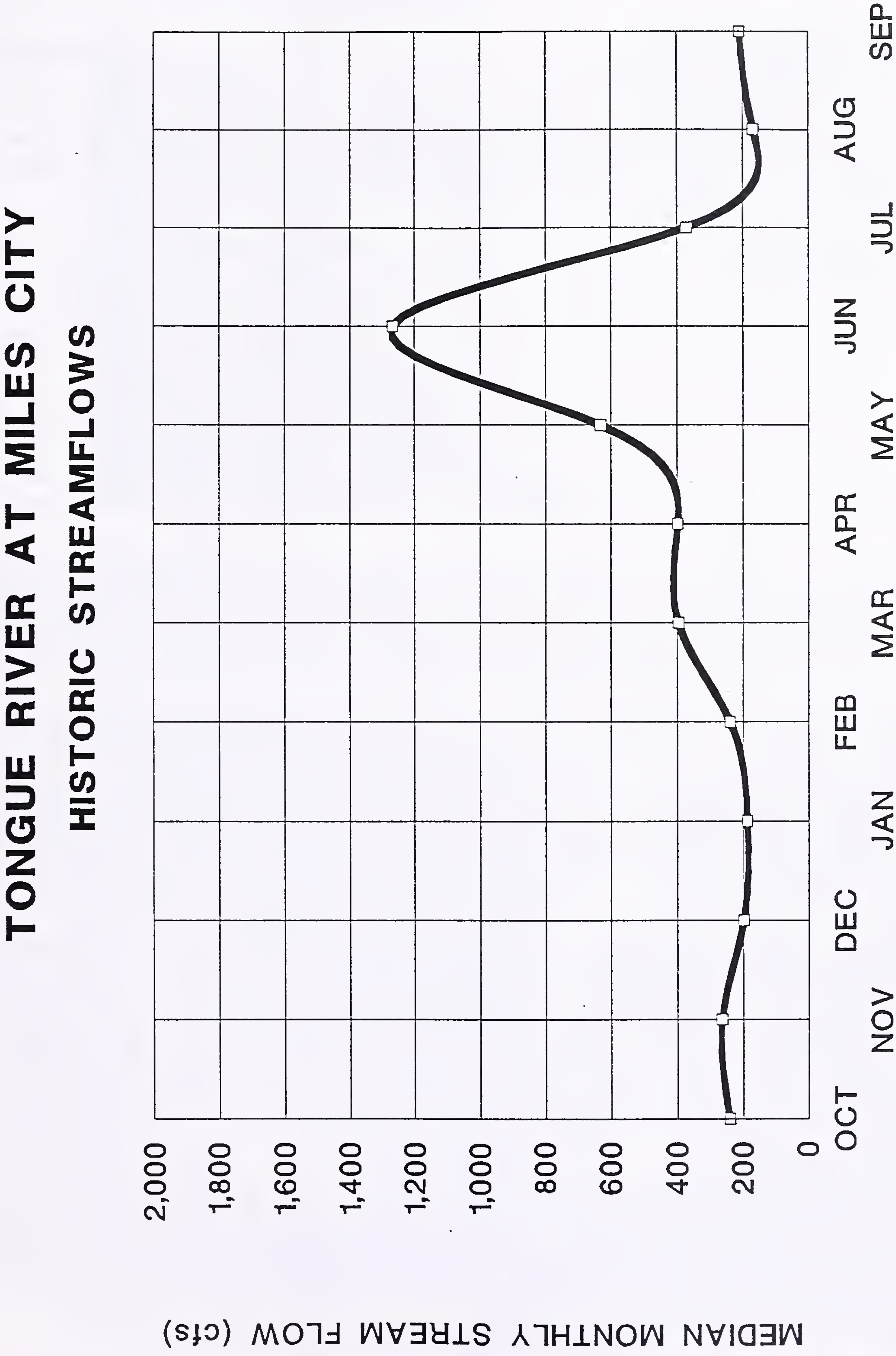


FIGURE 3–2

HISTORIC TONGUE RIVER FLOWS AT MILES CITY

Compact Commission 1990) (**see Figure 3-2**). Flood events and flood flows below Tongue River Dam and dominant discharge (a major component of channel formation) are discussed in Chapter 4, Hydrology and **Appendix E.**

Existing storage capacity of the reservoir is 67,000 acre-feet. The Tongue River Water Users Association operates the Tongue River Reservoir to meet irrigation contracts while maintaining safe storage and flows (Northern Cheyenne Tribe, Montana Department of Natural Resources and Conservation, and U.S. Bureau of Reclamation 1992). As a result of a 1978 flood event that damaged the spillway **(see Figure 3-3)** of Tongue River Dam, capacity is held at 20,000 acre-feet during spring runoff. Following the peak of spring runoff, the reservoir is typically allowed to fill to 40,000 acre-feet from May to June. Releases to water users are made on demand with a minimum instream flow of 75 cfs maintained for fish and wildlife (Northern Cheyenne Tribe, Montana Department of Natural Resources and Conservation, and U.S. Bureau of Reclamation 1992). Based upon monthly evaporation and precipitation data for the Broadus, Montana, weather station (U.S. Department of Agriculture 1974), net annual evaporation from the reservoir was calculated at 5,090 acre-feet.

The major tributaries of the Tongue River are Hanging Woman, Otter, and Pumpkin creeks. Numerous minor tributaries drain watersheds of varying sizes. These minor tributaries flow only in response to precipitation, runoff, and snowmelt. Major tributaries generally flow throughout the year but may flow intermittently within certain reaches during a season or a dry year.

3.7.1.1 Surface Water Quality

Water quality in Tongue River meets suitability standards for public and private water supplies, livestock use, and irrigation. Concentrations of sulfate and total dissolved solids (TDS) are the contaminants that most severely threaten the suitability of Tongue River water. Specific electrical conductance (SEC) of water is a method of evaluation that indicates the concentration of ionized minerals or dissolved solids in solution.

Water in Tongue River upstream of the reservoir at the Montana-Wyoming state line has an average sulfate concentration of 156 milligrams per liter (mg/l), TDS concentration of 410 mg/l, and SEC of 659 micromhos per centimeter. Tongue River Reservoir at the dam has an average sulfate concentration of 180 mg/l, TDS of 440 mg/l, and SEC of 691 micromhos per centimeter. Tongue River at Birney Day School has an average sulfate concentration of 205 mg/l, TDS of 490 mg/l, and SEC of 665 micromhos per centimeter. National Secondary Drinking Water Standards for human drinking water recommend 500 mg/l of TDS and 250 mg/l of sulfate as contaminant level limits.

The Montana Bureau of Mines and Geology recommends maximum contaminant concentrations for drinking water and livestock use (Montana Bureau of Mines and Geology No date). Recommended sulfate is 250 mg/l for drinking water and 1,500 mg/l for livestock. TDS recommendations are 500 mg/l for drinking water and 5,000 mg/l for livestock. Recommended levels of SEC are a maximum of 1,000 micromhos per centimeter for drinking water.

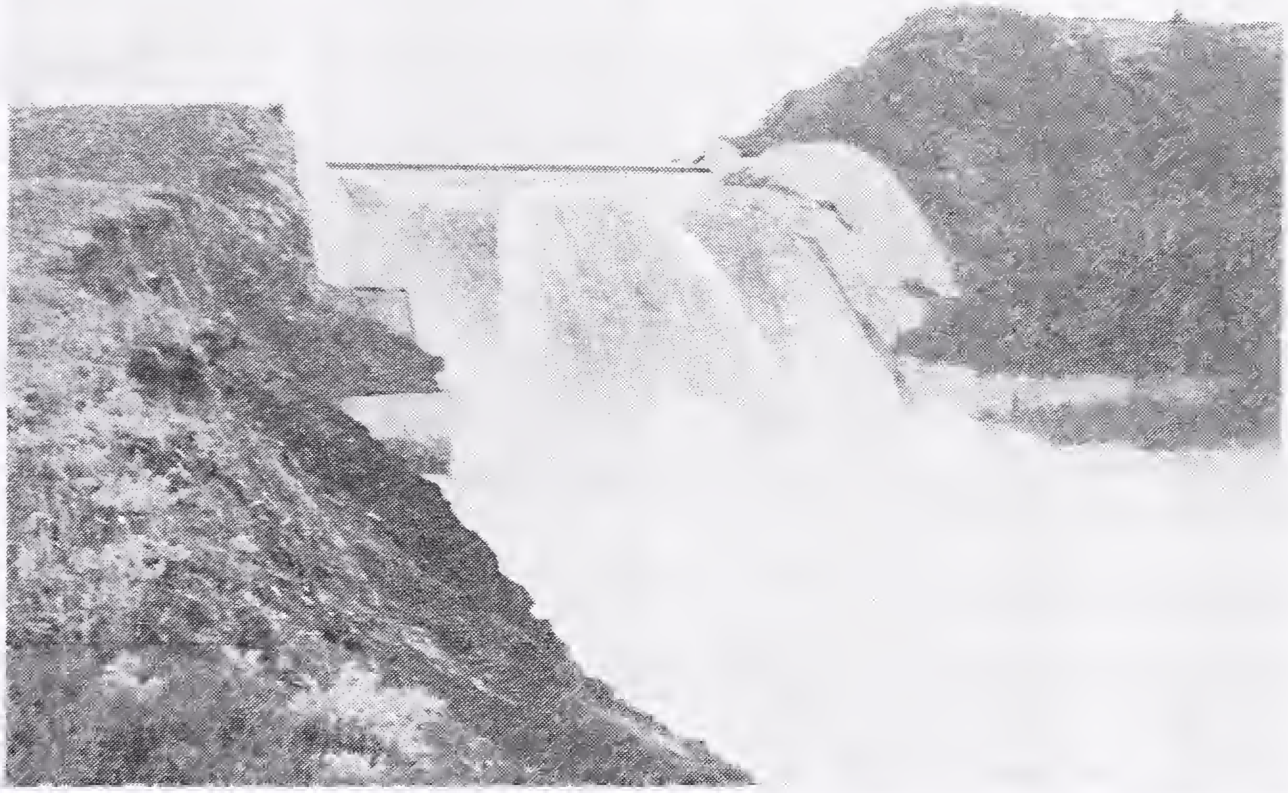


PHOTO SHOWING CLOSEUP VIEW OF 1978 FLOOD DISCHARGE

PHOTO SHOWING OBLIQUE AERIAL VIEW OF FLOOD DISCHARGE

FIGURE 3–3

1978 PHOTOGRAPHS OF SPILLWAY FLOOD DISCHARGE

3.7.1.2 Alluvial Valley Floors

Federal law restricts certain activities (such as mining), in designated alluvial valley floors. No designated alluvial valley floors (AVFs) are present within the immediate study area. However, there are extensive potential AVFs along and adjacent to the Tongue River and along most of the perennial tributary channels (Office of Surface Mining, Reclamation, and Enforcement 1985). All AVF and potential AVF designations result from applying the draft "Alluvial Valley Floor Identification and Study Guidelines" (U.S. Department of the Interior 1983).

3.7.2 Ground Water Resources

Excluding alluvial aquifers and aquifers influenced by surface topography, ground water flow in the Tongue River Reservoir area is to the northeast. In the Tongue River Reservoir area, three aquifer-bearing geologic formations overlie the deeper impermeable shales of the Montana Group. From deep to shallow, they are: the Fox Hills, Tullock-Hell Creek (Fox Hills-Lower Hell Creek), and Tongue River members of the Fort Union Formation. The Upper Cretaceous Bearpaw Shale is considered a major confining unit within the group (Slagle et al. 1983). In addition, alluvial sands and gravels serve as productive aquifers where they are thick and well developed. Deep sandstones of the Lakota Formation, carbonate rocks of the Madison Group, and dolomite of the Red River Formation provide potential but little-used ground water sources. The Fox Hills Formation can yield up to 200 gallons per minute (gpm) to a well, the Tullock-Hell Creek aquifer can yield up to 85 gpm, and the hydrogeologic units of the Tongue River Member produce up to 50 gpm.

3.7.2.1 Ground Water Quality

Ground water from the Fox Hills Formation contains total dissolved solids (TDS) concentrations in the range of 200 to 2,300 mg/l (U.S. Bureau of Reclamation 1985) and the Tullock-Hell Creek Aquifer averages TDS concentrations of 1,000 mg/l (Woessner et al. 1981). The hydrogeologic units of the Tongue River member contain TDS concentrations in the range of 200-3000 mg/l (Woessner et al. 1981). Quaternary age alluvial aquifers along the Tongue River and its tributaries can yield up to 700 gpm, with TDS between 280 and 5,600 mg/l (U.S. Bureau of Reclamation 1985).

There is incomplete information about the three deep aquifers below the Bearpaw Shale identified by Woessner et al. (1981). The Lakota Sandstone is estimated to be 200 feet thick but no data are available on yields or water quality. Artesian flows were encountered in the aquifer during oil exploration drilling and a TDS concentration for the Lakota Sandstone was observed at 2,000 mg/l during the drilling of a U.S. Geological Survey test well. The Madison Group and Red River Formation were encountered during test well drilling (Brown et al. 1977; Blankennagel et al. 1977; and Blankennagel et al. 1979). While yields are available, production in excess of 1,000 gpm can be expected from the Madison Group with TDS concentrations of 1,000 to 1,500 mg/l and temperature in the range of 176° to 212°F. Conclusions with respect to the Red River Formation are few. Yields are expected to be variable and concentrations of TDS are expected to be high.

3.8 WETLANDS

Wetlands are biological communities such as bogs, fens, marshes, and wet meadows that are transitional between aquatic and terrestrial ecosystems. As part of the National Wetlands Inventory, the U.S. Fish and Wildlife Service defined wetlands as having one or more of the following three attributes:

- periodically, the land supports predominantly hydrophytes;
- the substrate is predominantly undrained soils; and
- the substrate is nonsoil and is saturated with water or covered by shallow water at some time during the growing season.

The most widely accepted definition for jurisdictional wetlands is published in the Clean Water Act of 1972 (P.L. 92-500) as follows:

> "Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.
>
> Wetlands must possess three essential characteristics: 1) hydrophytic vegetation, 2) hydric soils, 3) wetland hydrology, which is the driving force creating all wetlands. These characteristics and their technical criteria for identification purposes are described in the following sections. The three technical criteria are mandatory and must all be met for an area to be identified as wetland."

For the purpose of analysis in this document, the project sponsors did not differentiate between riparian and wetland habitat; this approach was based on a 1992 vegetation report prepared by the Montana Riparian Association (MRA) during early planning for the project (Miles and Hansen 1992). The vegetation report identified 541 acres of riparian-wetland habitat type in the reservoir area below elevation 3429 feet that would be affected by the project. In describing the riparian-wetland habitat, MRA stated that the overstory cover, structural diversity of multiple layers within the forested stands, a large contiguous stand (block) of trees near the inlet, open areas and intervening "edges", plus the abundance of food and water sources made the area important wildlife habitat.

In preparing the Fish and Wildlife Coordination Act Report (CAR) for the project, USFWS followed the example set in the vegetation report and recommended mitigation measures based on overall habitat values and not a strict delineation of wetlands verses riparian acres. It was recognized in the CAR that not much would be gained by differentiating between wetlands and riparian habitat for the Tongue River Basin Project since the high habitat value assigned was a result of a combination of the two.

To more specifically characterize the existing environment of the project area, the project sponsors have estimated that 5 to 25 percent of the 541 acres of riparian-wetland habitat identified by MRA (27 to 135 acres) would fall within the definition of "jurisdictional wetlands." Classification of "jurisdictional wetlands", however, must comply with the criteria contained in the 1987 Corps of Engineers Wetlands Delineation Manual (U.S. Army Corps of Engineers 1987). Although the project sponsors' estimate is not based entirely

on the COE 1987 manual, it does reflect their close consideration of the MRA report results (and especially the associated vegetation communities mapping effort), U.S. Soil Conservation Service soil classification maps for the study area, aerial photographs of the study area, and several field investigations in the area around the reservoir. Additionally, the project sponsors have consulted with USFWS during efforts to estimate wetland acres in the project area.

3.9 AQUATICS/FISHERIES

Although monitoring of the fishery would be performed from the reservoir to the T&Y Diversion during construction activities, the primary project study area has been limited to a 20-mile reach encompassing the reservoir area because of the scope of identified issues and extent of assessable effects from the proposed action. The study area is located approximately 100 miles northeast (downstream) of the river headwaters in the Big Horn Mountains in Wyoming and 180 miles southwest (upstream) of Miles City, Montana, at its confluence with the Yellowstone River. The reach of the Tongue River, including the Tongue River Reservoir, from about Decker, Montana, to its confluence with Four Mile Creek (the project study area) is situated in the southwestern portion of the Fort Union coalfield region. Aquatic biota in the project study area, including fish, are typical of those warm-water species found in the Northern Great Plains, with the exception of a remnant brown trout population and non-reproducing (stocked) rainbow trout fishery that exists for a limited distance downstream of the Tongue River Dam. Deep-water withdrawal from the reservoir, resulting in cool-water discharges, perpetuates the trout fishery. A viable rock bass population also exists in, and is unique to, the Tongue River in Montana.

Instream flows in the Tongue River are required under the Yellowstone River water reservations of 1978. Montana Department of Fish, Wildlife and Parks (DFWP) was granted a reservation for 75 cfs at Miles City in order to protect aquatic life. This reservation is rarely satisfied because of its late priority date. An additional problem with this reservation is that it does not reflect the actual water requirements for fisheries in the river. This is partially offset in that the high priority decreed water right at the T &Y Diversion for 190 cfs protects the resident sport fishery for all but the final 20 miles of river below the diversion (Montana Department of Natural Resources and Conservation 1991).

3.9.1 Algae

The algae identified from the Tongue River system generally indicate a moderately enriched, hard-water environment with tendencies toward eutrophication (nutrient enrichment and related loss of dissolved oxygen) when impounded with excessive sediment and salinity near the lower end of the river (Bahls and Bahls 1977; Interstate Commerce Commission 1992). Diatoms are the predominant algae in the southern Fort Union coalfield region (Bahls, Weber, and Jarvie 1984) and in the study reach. Periphyton such as green algae *Cladophora* are abundant in the Tongue River system during fall, while diatom species are prevalent in the spring. Blue-green species *nostoc* are the dominant periphyton in lower reaches of the Tongue River system (including the reservoir), where turbidity is high and the surrounding area is modified by heavy grazing and irrigated hay production.

3.9.2 Macroinvertebrates

Macroinvertebrates are abundant in the Tongue River and its tributaries (Interstate Commerce Commission 1994). A 2-year Water Quality Bureau biological benthic inventory of streams draining the southern Fort Union coalfield area in southeastern Montana, including stations on the Tongue River, describes the existence of a fairly diverse, highly productive, generally healthy, and dynamic set of benthic macroinvertebrate associations in the study area (Klarich and Regele 1980). Turbidity, siltation, and flow depletion in the lower portion of the Tongue River affect the relative abundance and biomass of certain sensitive species (Interstate Commerce Commission 1992).

3.9.3 Fish

3.9.3.1 Tongue River Reservoir

Tongue River Reservoir supports a warm-water fishery that is primarily self-sustaining (Interstate Commerce Commission 1992). The reservoir contains 24 species of fish (**see Appendix F**). Game fish include northern pike, channel catfish, largemouth and smallmouth bass, walleye, sauger, and brown and rainbow trout. Sport fish also of interest to the angler are black and white crappie, rock bass, bullhead, sunfish, and yellow perch (Montana Department of Fish, Wildlife and Parks No date; U.S. Department of Interior, Fish and Wildlife Service 1992). Other forage fish common to warm-water fisheries in Montana are also found in the reservoir including the spottail shiner introduced recently as a food source for the game fish population.

The reservoir has been operated at reduced average pool elevations for the past 16 years since high flows damaged the spillway in 1978. Reservoir drawdowns have affected the shallow cove and small bay habitat, driving immature game fish from preferred rearing areas into the open reservoir, thereby increasing losses to predation.

DFWP personnel found declining use of the reservoir by walleye for spawning and rearing, beginning around 1980. This was assumed to be the result of, or aggravated by, winter drawdowns. In recent years, DFWP has stocked walleye fry and fingerlings in the reservoir to supplement natural reproduction. That agency has reported a recent (1990) resurgence in the walleye fishery in response to the stocking program. They also reported increased crappie sizes in all age classes, probably in response to increased walleye predation on small crappie (U.S. Department of the Interior, Fish and Wildlife Service 1992). Recent creel census data on fishing pressure indicate restrictions on harvest limited to older age classes of crappie may soon be warranted (Montana Department of Fish, Wildlife and Parks No date). Crappie harvest is over 25 times higher than it was in the early 1980's and accounts for about 89 percent of the fish kept from the reservoir.

The annual reservoir temperature under present operation ranges from 32° to 74°F. The reservoir does not thermally stratify in summer, apparently due to the slight current, water withdrawal management, and wind action. Despite lack of stratification, there is a slight dissolved oxygen (DO) deficit near the reservoir bottom during part of the summer (Whalen 1979 *In* Larry Dolan, Department of Natural Resources and Conservation, memo to Greg Ames, March 30,1994). Fluctuating water levels combined with climatological factors produce a habitat favoring warm-water species, although the late-summer through early spring reservoir drawdowns of recent years likely impacted some fish populations.

3.9.3.2 Tongue River Upstream of the Reservoir

The influence of the Tongue River reach upstream of the reservoir upon those species largely dependant on the reservoir has not been thoroughly studied, although limited river sampling has been done (U.S. Department of Interior, Fish and Wildlife Service 1992; Department of Fish, Wildlife and Parks No date). DFWP's Application for Reservation of Water in the Yellowstone River Basin (Montana Fish and Game Commission 1976) lists 14 fish species present in the Tongue River from the Wyoming line to the reservoir, including sauger, walleye, smallmouth bass, channel catfish, and rock bass, all of which are also found in the reservoir. Sampling suggests use of this river reach by migrating sauger and walleye in the spring for spawning when sufficient flows exist. There is potential use by other fish species from the reservoir, but this has not been documented.

3.9.3.3 Tongue River Below the Dam

DFWP classifies approximately 189 miles of the Tongue River downstream from the dam to its mouth into four reaches: the dam to Four Mile Creek (about 10 miles in length and part of the present focus of assessment), Four Mile Creek to S-H Diversion, S-H Diversion to T&Y Diversion, T&Y Diversion to the Yellowstone River.

A total of 19 fish species are listed by DFWP in the stretch of the river from the Tongue River Dam to Four Mile Creek, which includes the major game and sport fish species found in the reservoir (Department of Fish, Wildlife, and Parks No date). A reproducing population of brown trout exists in this reach and DFWP stocks 2,000 rainbow trout in this section annually (Phillip Stewart, Department of Fish, Wildlife, and Parks, personal communication, December 12, 1994). The trout populations exist because the outlet works draws water from near the reservoir bottom and releases this relatively cool water into the river.

The low level outlet releases water as much as 10°F cooler than the reservoir inlet water temperature, which may reach 78^{0} F in summer (L.Dolan, pers. comm., March 30, 1994). Further downstream the water warms, and the river changes into a more typical warm-water prairie stream. From Four Mile Creek to S-H Diversion, DFWP lists 22 warm-water fish species in the river. From S-H Diversion to T&Y Diversion, it lists 15 warm-water species, and from T&Y Diversion to the Yellowstone River, 20 warm-water species are listed (Department of Fish, Wildlife and Parks No date). The latter reach includes paddlefish, shovelnose sturgeon, the blue sucker, and the sturgeon chub. The river below the T&Y Diversion is also an important historical spawning area for sauger and shovelnose sturgeon migrating from the Yellowstone River when sufficient flows exist in spring and early summer. High flows are necessary during this timeframe to ensure successful migration, spawning and rearing of these fishes. Reduced flow as a result of drought during the 1980s and reservoir operations since 1978 have affected the fishery (U.S. Department of the Interior, Fish and Wildlife Service 1992).

3.9.4 Aquatic Amphibians and Reptiles

Amphibians observed in the Tongue River Dam area included the leopard frog, and the northern chorus frog (**see Appendix F**). The snapping turtle, a reptile, also has been seen (U.S. Department of the Interior, Fish and Wildlife Service 1992). Other common species associated with aquatic habitats for some

part of their life cycle are likely to include: the tiger salamander, plains spadefoot toad, painted turtle, and spiny-softshell turtle (U.S. Department of the Interior, Fish and Wildlife Service 1992).

3.10 WILDLIFE

3.10.1 Terrestrial Wildlife

Past studies in the vicinity of the Tongue River Reservoir list twenty species of mammals and four species of non-aquatic reptiles (Martin, DuBoise, and Youmans 1981). **Appendix F** lists the species observed in a decade-long study by DFWP, but does not include bobcat, mink, and white-tailed jackrabbit which are known to inhabit the area. Terrestrial reptiles in the area, but not included in the table, likely include the northern sagebrush lizard and garter snake (U.S. Department of the Interior, Fish and Wildlife Service 1992).

Terrestrial wildlife habitat in the study area is comprised of grasslands, scrub forests, and riparian plant communities fairly typical of the region. The Tongue River Basin provides extensive, good quality habitat for three species of big game animals: mule deer, white-tailed deer, and pronghorn antelope. A white-tailed deer herd uses the diverse riparian zone at the south end of the reservoir. Although a narrow intermittent band of riparian vegetation exists along the reservoir shoreline, its habitat value is limited to isolated pockets where naturally occurring drainages converge on the reservoir margin. These areas, and others located downstream of the dam, provide a multi-layered vegetation canopy and are considered good white-tailed deer habitat. Mule deer occur throughout the study area. They use the willow thickets and other woody vegetation at the south end of the reservoir during the summer and fall and use the upland scrub forest, north and east of the reservoir, during the winter months (U.S. Department of the Interior, Fish and Wildlife Service 1992).

The most visible aquatic habitat is Tongue River Reservoir; however, the Tongue River is more important ecologically, and is essential to much of the remaining natural flora and fauna. The river has been altered extensively by the dam and agriculture. As a result, the river has become more confined and incised, meanders and oxbows have become more isolated, and the riparian habitat along the river has dwindled (U.S. Department of the Interior, Fish and Wildlife Service 1992).

The majority of pronghorn antelope use of the immediate project area is on grassland habitat along Deer Creek, near the southeast side of the reservoir and north of the East Decker Mine, and on the west side of the reservoir around the Spring and Pearson Creek drainages, where antelope numbers have increased in recent years. This species is widely scattered throughout the project area and is generally considered moderately numerous (U.S. Department of the Interior, Fish and Wildlife Service 1992).

The zone of woody riparian habitat with its "layered" vegetative structure at the south end of the reservoir attracts a much more diverse song bird fauna than the surrounding grasslands and forests. The relatively narrow intermittent riparian areas were also found to have more than twice the number of species as were found in adjacent habitats (Eng 1994). Many of the species observed were neotropical migrants (birds that migrate between this area and the southern U.S. and tropical areas further south).

Several species of gamebirds occur within the general project area. Sharp-tailed grouse occupy upland habitats along the Tongue River Reservoir, although their populations are not high. Four of the five known historical leks were disturbed by the development of the East Decker Mine. The remaining lek was located along the west side of the reservoir (Martin, DuBoise, and Youmans 1981).

Decker (1990 *In* U.S. Department of the Interior, Fish and Wildlife Service 1992) reported high numbers of wild turkeys along the Tongue River and associated tributaries, and on lands reclaimed following coal mining on the east side of Tongue River Reservoir. One single-day count of 92 turkeys was made on a tract of reclaimed lands in February 1989.

Ring-necked pheasants are common, and although populations in southeastern Montana generally have been low in recent years, they may be considered locally numerous in certain areas, including in riparian areas along Tongue River and near the mouths of small tributaries. Tongue River pheasant spring breeding populations have shown improvement in recent years over those existing for nearly a decade (U.S. Department of the Interior, Fish and Wildlife Service 1992).

3.10.2 Waterfowl

Most species of waterfowl common to eastern Montana have been observed during migration on the reservoir or the river downstream from the dam. Mallards, shovelers, Canada geese, common mergansers, and blue-winged and green-winged teal are quite common during migration (Martin, DuBoise, and Youmans 1981). Gadwall and wood ducks are also common, and pintail occur. Canada goose production on Tongue River Reservoir has been monitored for many years by Decker Coal Company; since 1981, known nesting pairs have remained fairly constant, at between 16 and 24, with the number of young produced ranging between 37 and 98. The mallard was reported as a confirmed breeder on the site (Martin, DuBoise, and Youmans 1981). The American wigeon was listed as a suspected breeder based on its presence during the breeding season. Wood duck broods have since been observed at the upper end of the reservoir (John Berry, Decker Coal Company, personal communication, December 5, 1994); five pairs were observed on May 25, 1993. Dense cover at the south end of the reservoir makes it difficult to get an accurate estimate of nesting birds. Reservoir operations during the nesting season have been a major factor in the rate of nest failure. Decker's surveys indicate a high count of between 100 and 150 Canada geese each year on the reservoir (U.S. Department of the Interior, Fish and Wildlife Service 1992).

An aerial census of waterfowl numbers in October 1992, (peak of migration) revealed approximately 875 ducks on the entire reservoir during mid-day, of which 70 to 80 percent were mallards. One group of 30 to 35 redheads and another of 25 lesser scaup were present. Both species are dependent on an aquatic food source. This relatively low number and species diversity may indicate only moderate waterfowl habitat.

A large double-crested cormorant and great blue heron rookery has existed for some years in water-killed cottonwood trees at the southern end of the reservoir. Over the past several years, the dead trees supporting this rookery have begun to fall; ten nests were reportedly lost in this manner in a single year. The original rookery is now quite decadent. However, for the most part, these nest losses have been compensated for by a concurrent build-up of the nesting complex in live cottonwoods along the river further south (upstream). Overall, occupied nests for the decade 1980-89 ranged between 82 and 205 for the great blue heron, and for the last 5 years of that period, appear to have stabilized at between 106 and 124. Double-

crested cormorant nest counts reveal a generally similar picture, ranging between 101 and 188 for the 10-year period (U.S. Department of the Interior, Fish and Wildlife Service 1992).

A pair of ospreys are known to have successfully nested along the reservoir for several years. This osprey nesting was encouraged by construction of several artificial nest platforms, some of which have been used by Canada geese. In the spring of 1991, this osprey pair appears to have established a new nest about 1 mile from the reservoir, on Decker Coal Company land (J. Berry, pers. comm., December 5, 1994).

3.10.3 Threatened and Endangered, and Candidate Species

The U.S. Fish and Wildlife Service (USFWS) provided a list of threatened, endangered, and candidate species that may be present in the vicinity of the proposed project. The list formed the basis for the Biological Assessment prepared by USBR (Albers 1995). For information regarding the threatened, endangered, and candidate species that may be present in the project study area, see **Appendix B**.

3.11 VEGETATION

Natural vegetation in the vicinity of the Tongue River Dam and Reservoir is composed of plant communities that have developed in response to differing amounts of soil moisture, past disturbances (e.g., fire, floods, livestock grazing, recreational development and crop production), and other environmental factors. Species composition and growth patterns range from relatively dry mid-grass prairie, and coniferous forest dominated by Rocky Mountain juniper and ponderosa pine to moisture-dependent riparian forest vegetated by Great Plains cottonwood, green ash, and box elder with a diversity of deciduous shrubs and herbaceous species, adapted to moist growing conditions.

Plant communities on the margin of the reservoir have established as a result of fluctuations of reservoir water levels (generally between elevation 3,398 and 3,425 feet) since the dam was constructed. About 1,520 acres of riparian and wetland plant communities occupy the shoreline and upper end of the reservoir. Peachleaf willow, sandbar willow, and Great Plains cottonwood have colonized bare soil on large portions of the reservoir margin that periodically flood (below elevation 3,425 feet). Flooding usually occurs during spring runoff in years of high precipitation. For successful seed germination and growth, these species require bare, water-saturated soil in the spring, followed by slowly receding water levels during the growing season (Miles and Hansen 1992).

In recent years, reservoir water levels have been maintained well below full pool because of structural concerns with the dam and spillway. During most years, reservoir water levels are below elevation 3,410 feet from August to April and peak at elevation 3,420 feet for a week or two in June (see **Figure 3-4**). As a result, reservoir water fluctuations have infrequently flooded vegetated shorelines above elevation 3,420 feet. Infrequent flooding has allowed shrubs and trees that have colonized from seed to form dense stands down to elevation 3,420 feet. Below elevation 3,420 feet, annual inundation, wave action and, possibly ice formation has maintained the shoreline in a disturbed state. Consequently, species adapted to annual cycles of disturbance have become established (e.g., sandbar willow).

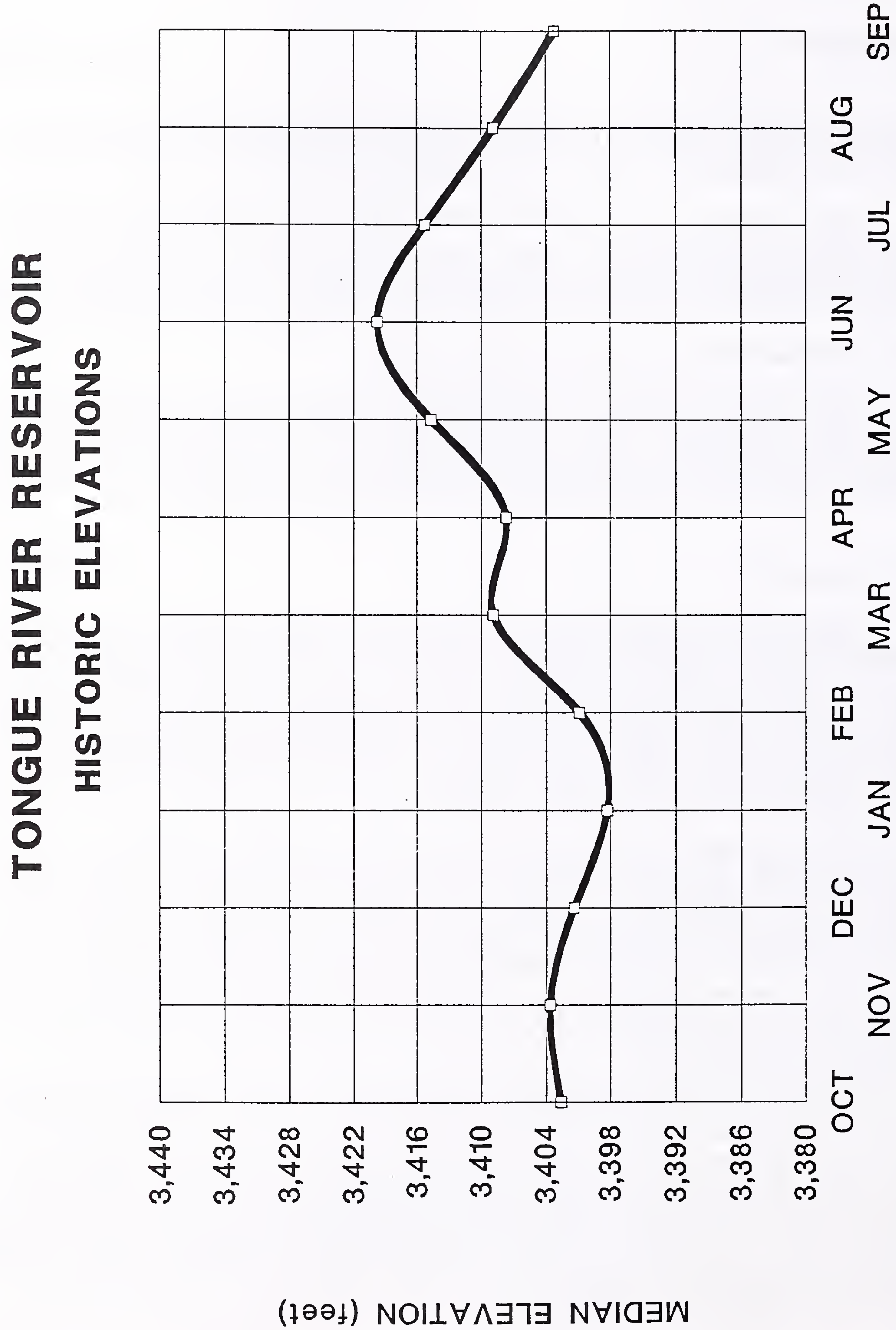


FIGURE 3-4

HISTORIC TONGUE RIVER RESERVOIR ELEVATIONS

Other major riparian plant communities are dominated by green ash/chokecherry (below elevation 3,425 feet, mostly at the upstream end of the reservoir), western wheatgrass (elevation 3,427 to 3,430 feet), and silver sagebrush/western wheatgrass (mostly above elevation 3,430 feet). Other minor wetland and riparian plant communities have a predominance of water smartweed, common spike-sedge, and prairie cordgrass.

Small populations of salt-cedar, a weedy shrub, have colonized portions of the reservoir margin. In the absence of control measures, this aggressive pioneer species could become established on much of the reservoir margin and displace desirable native species.

Major upland plant communities, adjacent to the reservoir include: grasslands comprised primarily of needle-and-thread, sun sedge, western wheatgrass, and bluebunch wheatgrass; shrublands dominated by big sagebrush and wheatgrass species; and forest communities with sparse overstory canopies of Rocky Mountain juniper and ponderosa pine, and grass-dominated herbaceous understories.

Downstream from the dam, riparian communities of Great Plains cottonwood, green ash, and box elder with understory canopies of sandbar willow, peachleaf willow, and other shrubs occupy portions of the Tongue River floodplain that have not been converted to cropland. Ecological factors that control the establishment and maintenance of riparian vegetation in the area are directly associated with periodic over-bank flooding and channel migration that scour streambanks and terraces, and deposit sediment. Cottonwoods and many willow species require nonvegetated, recently deposited alluvium for successful seed germination and establishment. The ideal environment for seed germination is constantly moist silt, sand, or gravel in full sunlight. Seeds germinate within 48 hours and must have a continuous supply of moisture for several weeks. Competition for moisture by herbaceous vegetation, particularly sod-forming grasses, greatly reduces survival of seedlings (Fowells 1965). Cottonwood and willow species may require maintenance of relatively high ground water levels during their first summer when their roots have not penetrated very deeply (Bradley, Reintjes, and Maloney 1991). Periodic over-bank flooding and newly deposited sand and gravel bars create ideal conditions for germination and growth of cottonwoods and willows.

Since construction of the dam, natural floods downstream have been reduced in magnitude and frequency. The effect that the existing dam has had on riparian vegetation and stream channel geomorphology is not well known; however, observations of downstream plant communities indicate that reproduction of cottonwoods and willows is occurring primarily along the streambanks, lower terraces subject to floods, and on sandbars. Periodic channel migrations accompanied by erosion of streambanks and deposition of alluvial material to form sand bars is essential to the maintenance of riparian cottonwood and willow communities. As channel meanders migrate, streambanks are eroded and trees and other plants are destroyed. At other places, however, streambanks are built where sediment is deposited by the river. Both cottonwood and willow rapidly colonize recently deposited sediments. The continual processes of channel migration and deposition of alluvium are important to the establishment of cottonwood and willow communities.

Older stands of cottonwood on portions of the floodplain that have not been inundated since construction of the dam may be dying out due to natural aging. Typically, development of plant communities begins with seedlings of sandbar willow and cottonwood becoming established on gravel bars or other fluvial deposits. After about 15 years, cottonwood saplings become dominant and willow begin to decline (Boggs 1984). After about 30 years, riparian cottonwood forests are well developed and after 60 years, mature trees

start to decline in vigor and die. Most cottonwoods live less than 90 years, usually dying from heart rot and windthrow (Boggs 1984).

3.11.1 Ethnobotanical Resources

Investigations of historic and current use of plants in the vicinity of the Tongue River Reservoir identified 62 ethnobotanical plant species used by Native Americans (Aaberg and Tallbull 1993). Some ethnobotanical species such as scouring-rush, great bulrush, and cattail are restricted to shoreline and wetland habitats along the reservoir margin; these species are common in eastern Montana.

3.12 BIODIVERSITY

Recent federal policies have established that conservation of biological diversity is of national importance and should be addressed in the NEPA process and in other federal management and planning activities. Biological diversity is defined as the variety of life and its processes, including the variety of organisms, genetic differences among them, and communities and ecosystems in which they occur (Keystone 1991). Fundamental to the understanding of biological diversity is the recognition that the biological world is not a series of unconnected elements, and the richness of the mix of elements and the connections between those elements are what sustain the ecosystem as a whole.

The basic goal of biodiversity conservation is to maintain naturally occurring ecosystems, communities and native species. Managing for biological diversity through ecosystem management, is complex and requires consideration of the ecosystem as a whole, rather than focusing on single species or isolated habitats. According to the Council on Environmental Quality (1993), general principles for managing biodiversity are:

1) Manage at the ecosystem level.

2) Protect communities and ecosystems.

3) Minimize habitat fragmentation and promote the natural pattern and connectivity of habitats.

4) Promote native species and avoid introducing non-native species.

5) Protect rare and ecologically important species.

6) Protect unique or sensitive environments.

7) Maintain or mimic natural ecosystem processes.

8) Maintain or mimic naturally occurring structural habitat diversity.

9) Protect genetic diversity.

10) Restore ecosystems, communities, and species.

11) Monitor biodiversity impacts.

Biological diversity in terrestrial communities within the project area and the region results from the interspersion of natural habitats (i.e., prairie grasslands and shrublands; dry ponderosa pine forest and savannah; deciduous, riparian forests along floodplains of perennial streams; wetlands at springs and water bodies) with habitats created by human activities (i.e., riparian zone along the Tongue River Reservoir, cropland, and reclaimed mined lands). Natural habitats generally have higher species diversity (both plants and associated wildlife) than do human-created or human-induced habitats. Typically, human-created and human-induced plant communities have low species diversity and are comprised of introduced, exotic species (various grasses used for hay and other crops), and species adapted to colonization of disturbed habitats (e.g., weeds, sandbar willow, cottonwood, and cattail). Natural communities have a diverse mixture of grasses, forbs, shrubs, and trees in various stages of succession.

Habitat diversity in terrestrial plant communities of the project area is increased by vegetation structural features such as height and layers of canopies formed by herbaceous species, shrubs and trees. Plant communities with well-developed herbaceous, shrub, and tree canopies provide the greatest number of niches for diverse wildlife. Regionally, forested riparian areas and ponderosa pine communities provide habitat for the greatest variety of wildlife.

Natural habitats such as prairie grassland, shrubland, and ponderosa pine communities are relatively common and are predominant landscape components in the project area and regionally. Throughout the United States and Canada, however, native prairie grassland and shrubland have been greatly decreased by agricultural activities, fire suppression, livestock overgrazing, and introduction of aggressive exotic plants. Many wildlife species associated with native prairie and shrubland are declining in abundance, and their geographic ranges are contracting. Species with a strong affinity for native prairie and shrublands include: pronghorn antelope, badger, swift fox, black-tailed prairie dog, grasshopper mouse, white-tailed prairie dog, black-footed ferret, sage grouse, sharp-tailed grouse, Baird's sparrow, burrowing owl, upland sandpiper, long-billed curlew, Swainson's hawk, ferruginous hawk, western kingbird, meadowlark, loggerhead shrike, grasshopper sparrow, prairie rattlesnake, plains spadefoot toad, short-horned lizard, and sagebrush lizard.

Species diversity in aquatic habitats of the project area has been altered by construction of the Tongue River Dam, irrigation water diversions, and introduction of plants and fish not native to the region. Fish populations in the Tongue River Reservoir are predominantly comprised of introduced species such as smallmouth bass, largemouth bass, rock bass, northern pike, brown trout, rainbow trout, carp, walleye, and crappie. Similarly, a high proportion of fish species in the Tongue River are introduced. Currently, native fish (e.g., blue sucker, pallid sturgeon, plains minnow, flathead chub, and sturgeon chub) and other aquatic species (e.g., snapping turtle and spiny softshell turtle) present in the Tongue River are of concern because of reductions in population abundance over their range of occurrence.

Although species diversity is relatively high in the Tongue River and Tongue River Reservoir, much of the diversity results from proliferation of introduced species, perhaps at the expense of native species. From an ecosystem management perspective, introduction of non-native species should be avoided and management for native species encouraged. Although a large component of the fishery is composed of non-native species, these fish are valued for recreational purposes and management decisions have been made to retain and enhance their dominance within the project area.

3.13 SOCIOECONOMICS

3.13.1 Social Environment

The study area for sociological resources (social life, community service providers, and housing) includes the Northern Cheyenne Reservation and the communities of Ashland and Birney, Montana. The study area was limited to the reservation and these communities because of the TERO Agreement (see Economic Environment) entered into by the Northern Cheyenne Tribe and the State of Montana.

3.13.1.1 Social Life

The Cheyenne first lived in the upper midwestern region of the United States (Bryan Jr. 1985). Around 1830, the Cheyenne divided into two groups, the Northern and Southern Cheyenne. The Southern Cheyenne moved south and settled in parts of Arkansas, Colorado, Kansas, and Oklahoma; whereas the Northern Cheyenne moved into the Black Hills of South Dakota, northern Wyoming, and southern Montana. The Northern Cheyenne eventually settled in the Tongue River area of Montana. In 1884, President Chester Arthur signed an executive order establishing the 371,200-acre Tongue River Indian Reservation. In 1891, President William McKinley issued an executive order expanding the reservation to 444,157 acres and referred to the reservation as the Northern Cheyenne Indian Reservation, which eventually replaced the old name of the Tongue River Indian Reservation (Weist 1977).

Events of importance to social life on the reservation include ceremonial life (e.g., sweats, fasting, sundance), pow-wows, school sporting events, rodeos and gathering food (fishing, hunting, berry gathering), outdoor hiking, and riding horseback on the reservation.

3.13.2 Community Service Providers

3.13.2.1 Education

Public schools on or near the reservation include Lame Deer Elementary (kindergarten through grade 6), Lame Deer Middle School (grades 7 and 8), Lame Deer High School (grades 9 through 12), Birney School (kindergarten through grade 8), Ashland Elementary School (kindergarten through grade 6), and Ashland Middle School (grades 7 and 8). Northern Cheyenne Tribal Elementary School (kindergarten through grade 8) and Northern Cheyenne Tribal High School (grades 9 through 12) in Busby are BIA-funded private schools, accredited by the State of Montana. St. Labre Indian School in Ashland is a Catholic parochial school providing education to students enrolled in kindergarten through grade 12. St. Labre Elementary School is not accredited by the State of Montana, but the high school is state accredited (Sharyn Thomas, Rosebud County Superintendent, personal communication, December 1, 1994).

Lame Deer High School opened in 1994. Prior to that time, high school students from Lame Deer and the surrounding area were bused to Colstrip, St. Labre, Busby, Hardin, or Broadus, Montana, to attend high school (S. Thomas, pers. comm., December 1, 1994). To open the high school by fall 1994, a large modular unit was purchased to be used as temporary classrooms. The modular unit probably will be used in

the future to house middle school students, freeing up the middle school for elementary school students (Leslie Wells, Lame Deer High School, personal communication, December 6, 1994).

Total school enrollment increased between school years 1991-92 and 1993-94 in the Lame Deer, Ashland, and Birney schools and decreased in the Northern Cheyenne Tribal School. Preliminary school enrollment numbers for school year 1994-95 indicate increased enrollment over 1993-94 school year for Lame Deer, Ashland, and Busby schools and decreased enrollment for Birney School. In school year 1994-95, preliminary enrollment figures were 544 students in Lame Deer School; 119 students in Ashland School; 188 students in Northern Cheyenne Tribal School; 12 students in Birney School; and 368 students in St. Labre School (Montana Office of Public Instruction 1994; S. Thomas, pers. comm., December 1, 1994).

Dull Knife Memorial College was chartered by the Tribal Council in 1975 as part of the Northern Cheyenne Indian Action Program to provide vocational training for mining jobs in communities near the reservation. Academic courses were offered in 1978; however, since that time, the curriculum has expanded and the college now offers an Associate of Arts Degree in academic disciplines, an Associate of Applied Science in vocational areas, vocational certificates in several skill areas, and G.E.D. instruction and testing (Montana Office of Public Instruction and Montana Board of Crime Control No date; Feeney 1986).

3.13.2.2 Law Enforcement

Law enforcement is provided on the reservation by the Bureau of Indian Affairs (BIA) Law Enforcement Office, the Montana Highway Patrol, the Rosebud County Sheriff's Department, and the Big Horn County Sheriff's Department. The BIA Law Enforcement Office is the primary agency for maintaining law and order on the reservation (Wood Star, Bureau of Indian Affairs, personal communication, December 1, 1994).

The BIA Law Enforcement Office consists of the Police Department and Criminal Investigation Department. The latter is staffed by two criminal investigators, responsible for investigating major crimes committed on the reservation (Winfield Russell, BIA Criminal Investigation Bureau, personal communication, December 1, 1994). The Police Department is staffed by 14 officers, responsible for law enforcement duties on the reservation (U.S. Department of the Interior 1994).

The Adult Detention Facility, located in Lame Deer, was renovated in 1986 to house 18 adult offenders. Five jailers are on staff. There is no juvenile detention holding facility on the reservation. If a juvenile is apprehended by the police, parents of the juvenile are notified to pick up their child at the police station (Wayne Head Swift, BIA Police Department, personal communication, December 2, 1994). Juveniles apprehended for more serious crimes are transported to the juvenile detention center in Billings (W. Star, pers. comm., December 1, 1994).

The Montana Highway Patrol and county sheriff departments have limited jurisdiction on the reservation: they respond to traffic violations and accidents, but only have jurisdiction over non-Indians (Colonel Craig Reap, Montana Highway Patrol, personal communication, December 1, 1994).

3.13.2.3 Fire Protection

Wildland fire protection on the reservation is provided by the BIA Forestry Department with cooperative agreements with the BLM, Department of State Lands, U.S. Forest Service, Northern Cheyenne Tribe, volunteer fire departments on the reservation, and local ranchers who live close to the reservation boundaries (Renessa Russette, BIA Forestry Department, personal communication, December 1, 1994). Structural fire protection is provided by volunteer firefighters in Lame Deer.

The service area of the Lame Deer Volunteer Fire Department includes Lame Deer, Ashland, Busby, and Birney, Montana. Six of the 12 volunteer firefighters are on call to respond to fire emergency situations. The two fire trucks used by the Fire Department are old and, with the hilly terrain on routes used to reach the communities they serve, probably only travel between 45 and 50 MPH. Although the volunteers are quick in responding to fire calls, the trucks slow the response time down to an estimated 35 minutes to reach Ashland, 20 minutes to Busby, and 35 minutes to Birney (Elrena Whitedirt, Lame Deer Volunteer Fire Department, personal communication, December 5, 1994). Water for firefighting purposes is not always readily available. Fire hydrants in the communities are limited and old, with many scattered homesites. The main source of water to fight fires in some areas is nearby streams.

Insurance Services Office (ISO) Commercial Risk Services, Inc. inspects the adequacy of fire departments nationwide to determine ratings for property covered by insurance agencies. On an ISO scale of 1 to 10, with class 1 being the highest rating and 10 being virtually unprotected, the Lame Deer Fire Department has a class 8 fire protection rating (Cara Feigal, ISO Commercial Risk Services, Inc., personal communication, December 5, 1994). The Fire Department needs additional volunteers, fire equipment, and firefighting vehicles to provide more reliable fire protection service to the communities (E. Whitedirt, pers. comm., December 5, 1994).

3.13.2.4 Ambulance Services

Ambulance and first responder services on the reservation are provided by the Northern Cheyenne Ambulance Service and the Ashland Quick Response Unit (QRU). The Northern Cheyenne Ambulance Service, operated by the Tribe, has 15 ambulance attendants including seven basic emergency medical technicians (EMTs), one EMT-I, six EMTDs (certified to operate defibrillator equipment), and one nurse. The 24-hour ambulance service maintains three first responder ambulances (P. Scott, Montana Department of Health and Environmental Sciences, personal communication, December 2, 1994).

The Ashland QRU is under the auspices of the Rosebud County Emergency Medical Service in Forsyth. The QRU is a non-transporting service that is first on the scene to stabilize patients. A pager system is used to alert the six first responders of emergency situations (P. Scott, personal comm., December 2, 1994).

3.13.2.5 Health Care

The Indian Health Service (IHS) Unit provides free health care services to Northern Cheyenne Tribal members, Native Americans from other tribes, and individuals who have proof they are a direct descendant of a Native American (Clara Spotted Elk, Northern Cheyenne Tribe, personal communication, December 7, 1994). Lame Deer comprises about 50 percent of the total IHS Service Unit population. Constructed in 1977,

the Lame Deer Health Center offers the following services (Montana Office of Public Instruction and Montana Board of Crime Control No date; U.S. Department of Health and Human Services 1994):

General Medical Services. Curative services, pharmacy, inpatient services, referral services to Crow Public Health Service Indian Hospital, 24-hour physician, and OB-GYN clinic.

Ambulatory. Optometry, dental, well-child clinic, prenatal clinic, and diabetes clinic.

Specially Arranged Services. Orthopedics, mammography, ENT, and communication disorders.

Preventative Health Services. Public health nursing, mental health, medical social services, environmental health/engineering, Women Infants and Children (WIC), family planning, prepared childbirth education, postpartum and newborn follow-up.

Community Health Representative (CHR) Program. Paraprofessional services in outreach care and health promotion/disease prevention throughout the communities.

During fiscal year (FY) 1993, the Lame Deer IHS Health Center had 40,558 direct outpatient visits, an increase of 5 percent over FY 1992 (U.S. Department of Health and Human Services 1994). Northern Cheyenne patients requiring in-patient care are referred to the Crow Public Health Service (PHS) Hospital, 42 miles from Lame Deer, or to community hospitals in Sheridan, Wyoming and Billings, Montana.

3.13.2.6 Public Assistance and Social Services

Public assistance and social services offered on the reservation are comparable to services available to other U.S. citizens. State-assisted programs such as food stamps, aid to families with dependent children, and Medicaid are provided through the Rosebud County Welfare Offices (Carol Charleson, Rosebud County Public Welfare Office-Colstrip, personal communication, December 5, 1994). The Welfare Office in Lame Deer, which handles most cases for reservation clients, also provides referrals for clients to other public/social service agencies on the reservation (Dianne Pearce, Rosebud County Welfare Office-Lame Deer, personal communication, December 5, 1994).

Many social service programs on the reservation are administered by the Tribe and receive funding from state, federal, and Tribal governments. Programs include General Assistance Program, Indian Child Welfare Act Program, Tribal Charity Program, Temporary Children's Shelter, Low Income Housing Energy Assistance Program (LIHEAP), Housing Authority, Elderly Program, Food Commodities Program, Welfare Reform Proposal Program, Alcoholism Program, Job Training Partnership Act Program, and WIC Program (D. Pearce, pers. comm., December 5, 1994; Louise Reyes, Social Services, Bureau of Indian Affairs, Billings Area Office, U.S. Department of the Interior, personal communication, December 5, 1994; Montana Office of Public Instruction and Montana Board of Crime Control No date).

3.13.2.7 Water Supply and Wastewater Treatment

The Northern Cheyenne Utilities Commission is responsible for operation and maintenance of community water and wastewater treatment facilities. Two more wells are needed in Lame Deer to provide

reliable water supply during peak usage in summer. The storage capacity of the water storage tank in Lame Deer is adequate to meet the demand of the community. In Busby, two new wells have been drilled; however, money is unavailable at this time to purchase the pumps needed to draw the water from the wells. The water storage tank in Busby does not provide enough storage capacity to meet the demand of the community. The number of wells and storage tank capacities in Ashland and Birney are adequate for the community served (Steve Little Bird, Northern Cheyenne Utilities Commission, personal communication, December 2, 1994).

The wastewater treatment facility in Lame Deer is sufficient for the size of the community. The sewage treatment facilities in Busby, Ashland, and Birney are over-designed; consequently, they do not receive enough water to operate efficiently (S. Little Bird, pers. comm., December 2, 1994). Scattered homesites throughout the reservation use individual wells and septic tank systems. A priority of the Tribal Development Fund, provided by the Settlement Act, is to address the inadequacies of water supply and wastewater systems on the reservation.

3.13.2.8 Solid Waste

Canister sites on the reservation are in Lame Deer, Busby, and Muddy. Garbage is hauled from the canister sites to Colstrip or Hardin, depending on the county in which the solid waste originated. About 1 year ago, the Tribe initiated curbside garbage pickup and disposal service. This service is provided free to the elderly and handicapped, but other Tribal members and the Housing Authority must pay a monthly fee if they choose to participate in the curbside service (C. Spotted Elk, pers. comm., December 7, 1994).

The annual budget for solid waste disposal is $179,000 ($105,000 general funds and $74,000 income generated). Additional funding is needed to purchase new equipment.

There are no licensed landfills on the reservation; however, there are several "informal" dump areas. Due to recent EPA regulations, the Tribe is in the process of closing and reclaiming these sites (C. Spotted Elk, pers. comm., December 7, 1994).

3.13.3 Warning System

A formal warning system and Emergency Plan (Montana Department of Natural Resources and Conservation 1992) has been installed to warn downstream inhabitants in the event of dam failure. The Emergency Plan has been prepared in compliance with the Montana Dam Safety Act and the resultant administrative rules. The purpose of the plan is to provide early warning to affected persons in the event of failure of Tongue River Dam. Besides providing this early warning, an additional objective is to minimize or eliminate danger to people or property located downstream of the dam.

The plan would need to be invoked under either of two potential emergency situations:

1. Failure of the dam has occurred or seems imminent.
2. A potentially hazardous situation is developing.

The plan is intended to provide instructions for notifying the proper authorities of a problem at the dam and is not intended to serve as an evacuation plan for notifying and evacuating downstream residents. Notifying and evacuating downstream residents are responsibilities of local authorities.

Persons living within 9 miles downstream of the dam likely would be flooded within the first 1.5 hours after a breach of Tongue River Dam. To facilitate that notification, a radio warning system has been installed between the dam and the Town of Birney. The warning receivers may be activated from the dam itself, from the dam tender's vehicle, from the Sheridan, Wyoming Police/Sheriff Dispatcher, and by the Rosebud County Deputy in Birney. A schematic of the emergency warning radio system is shown in **Figure 3-5.**

3.13.4 Housing

In 1990, there were 1,291 housing units on the Northern Cheyenne Reservation, of which 81 percent were occupied. Of the 1,045 occupied units, 59 percent were owner occupied and 41 percent were renter occupied. Approximately 76 percent of the housing units were single-family structures, 12 percent were multi-family units, 11 percent were mobile homes, and less than 1 percent were classified as "other" structures (U.S. Bureau of the Census 1991). Approximately 16.5 percent of the homes were built between 1985 and March 1990, 18.6 percent were constructed between 1980 and 1984, 39.6 percent were built between 1970 and 1979, 17.3 percent were constructed between 1960 and 1969, and 8 percent were built prior to 1969 (Montana Office of Indian Affairs 1994).

The majority of homes (estimated 80 percent) on the reservation are Housing and Urban Development (HUD) homes (Jerry Smith, Tribal Engineer, personal communication, December 2, 1994). Due to the construction of HUD homes, there are not a lot of mobile homes on the reservation (Barry Boler, Tribal Sanitarian, personal communication, December 2, 1994).

3.13.5 Population and Demographics

The population of Montana grew by 1.6 percent (12,375 individuals) during the 1980-90 decade, from 786,690 in 1980 to 799,065 in 1990. Sixteen counties in Montana experienced population increases during this 10-year period, ranging from 2.2 percent in Big Horn County to 17.7 percent in Gallatin County. The Northern Cheyenne Reservation is divided into Rosebud County and Big Horn County, with the majority of residents living in Rosebud County. Rosebud County ranked 11th among the 16 counties with population increases, with a 6.1 percent increase during the 1980-90 period, from 9,899 in 1980 to 10,505 in 1990. Big Horn County increased from 11,096 in 1980 to 11,337 in 1990 (U.S. Bureau of the Census 1991).

Total population of the reservation in 1990 was 3,923, an increase of 7.1 percent over the 1980 Census population. Lame Deer, the largest community on the reservation, had a population of 1,918 in 1990 (U.S. Bureau of the Census 1991).

In 1990, 90.3 percent of the population on the reservation were Native Americans, 9.3 percent were Caucasian, and less than 1 percent were classified as "other." Of the 3,542 Native Americans, 80.5 percent were Cheyenne.

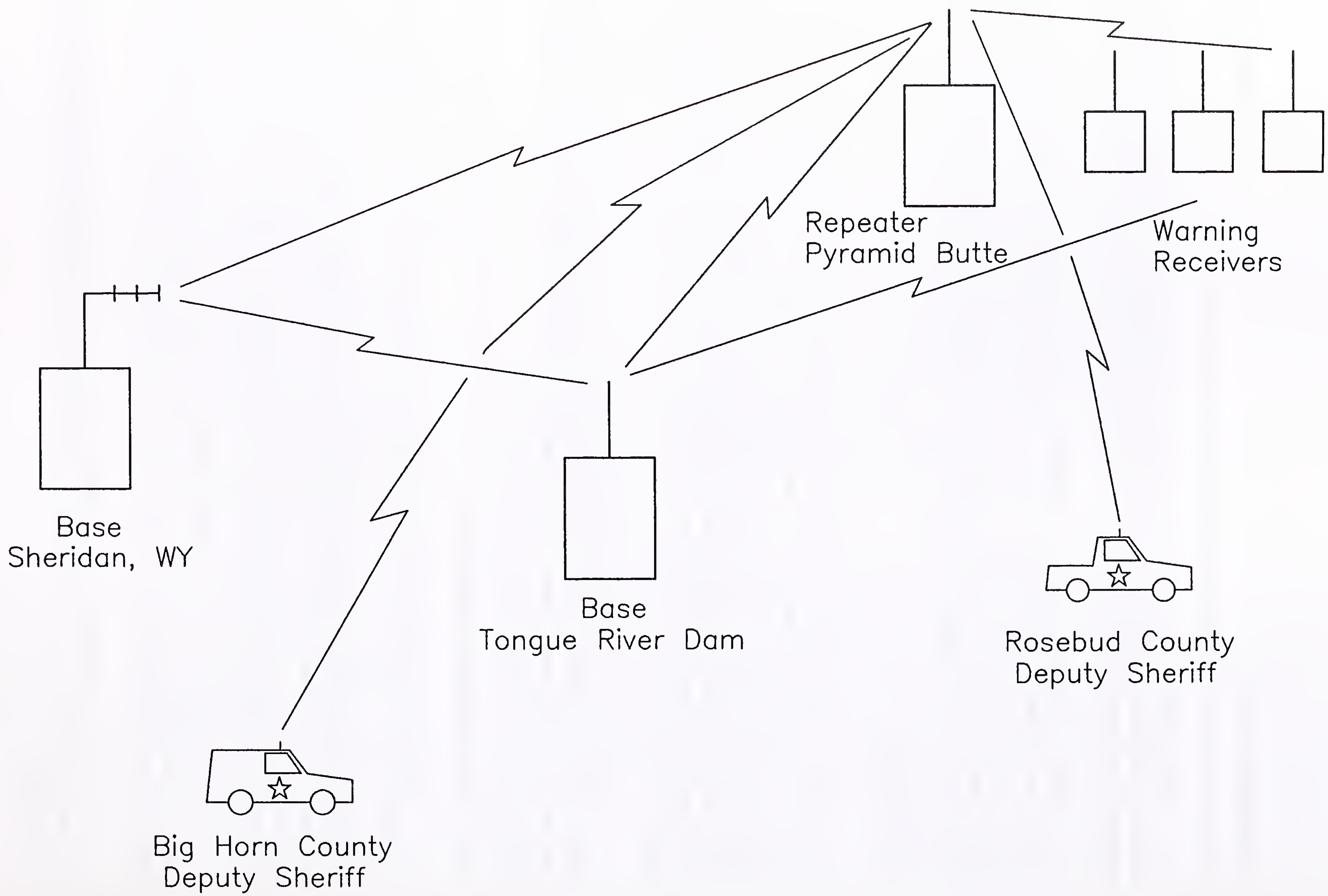


FIGURE 3–5

EMERGENCY WARNING RADIO SYSTEM

The population of the reservation was almost evenly divided between males (50.2 percent) and females (49.8 percent). Forty-six percent of the population were 18 years of age or less, 31.8 percent were between 19 and 39 years of age, 17.9 percent were between 40 and 64 years of age, and 4.2 percent were 65 years of age and older. About 38 percent of the residents on the reservation 15 years old and older had never been married, 43.1 percent were married, 1.7 percent were separated, 5.7 percent were widowed, and 11.2 percent were divorced (U.S. Bureau of the Census 1991). **Table 3-2** displays selected demographic characteristics for the Northern Cheyenne Reservation.

TABLE 3-2
Selected Demographic Characteristics - Northern Cheyenne Reservation (1990)

DEMOGRAPHIC CHARACTERISTIC	NORTHERN CHEYENNE RESERVATION
Household Type and Relationship	
Family	93.7%
Non-family	5.8%
Group Quarters	0.5%
Total Persons	3,923
Household Type and Size	
1 Person	15.0%
2 Persons	18.6%
3 Persons	15.7%
4 Persons	16.8%
5 Persons	15.2%
6 Persons	8.7%
7 or more Persons	10.0%
Total Households	1,045

Source: U.S. Bureau of the Census 1991.

3.13.6 Economic Environment

The study area for the economic environment is defined as the Tongue River Basin, including Rosebud, Big Horn, Powder River, and Custer counties in Montana, and Sheridan County in Wyoming. Primary employment and income impacts would most likely occur to the Northern Cheyenne Indian Reservation, due to the Settlement Act of 1992 (see Chapter 1) and the Tongue River Dam Project Northern Cheyenne Labor Relation Accord and Employment Preference Agreement (commonly called the TERO agreement). The Act required an agreement for employment preference for the Northern Cheyenne Tribe and

the TERO agreement set forth that preference; a target of 75 percent of employment on the project shall be from the Tribe. Since it is assumed that the project would be large enough to attract a non-local or out-of-basin contractor who would then bring in the remaining 25 percent of skilled and administrative workers, little other employment and income effects would be felt in the basin off the reservation. Minor employment and income impacts may be felt in the remainder of the basin if local subcontractors were involved in the project.

3.13.6.1 Employment Trends

Employment trends in the Montana Tongue River Basin peaked (18,500 jobs) at the height of the energy boom in 1980, then declined 2.5 percent by 1990 (U.S. Bureau of the Census 1994). In 1990, basin agricultural-related employment comprised about 14 percent of total basin employment, while mining and manufacturing totaled 8 percent.

Mining jobs in the Tongue River Basin doubled from 1970 to 1980 with the construction of five major coal mines in the basin during this time period. In addition, construction jobs, related to coal mine development, nearly tripled from 1970 to 1980, before declining 50 percent by 1985, when coal development had ceased.

Service- and finance-sector employment in the basin increased by 63 percent between 1970 and 1990 and comprised 28 percent of total employment in the basin in 1990. Government employment in the Tongue River Basin increased by about 60 percent between 1970 and 1990, and accounted for one of every five jobs in the basin in 1990. Employment in the remaining major economic sectors in the Tongue River Basin changed very little over the 1970 to 1990 time period.

Employment in Sheridan County, Wyoming is similar to the composition of employment in the Tongue River Basin. In 1990, there were 12,946 jobs in Sheridan County, of which 8 percent (1,001) were related to agriculture, 22 percent (2,862) were in government, and 44 percent (5,695) were in the service and retail trade sectors. Sheridan County also has a number of residents who commute to work in Montana. In 1990, 515 residents of Sheridan County worked in Montana (U.S. Bureau of the Census 1994). Most of the commuting employment was related to work at the Decker and Spring Creek coal mines in Big Horn County, Montana, where about 419 Wyoming residents worked (U.S. Bureau of the Census 1994). In addition to the commuting employment, recreational activities at the Tongue River Reservoir contribute to the creation of service and retail job employment in Sheridan County.

In 1993, the civilian labor force in the Tongue River Basin totaled 17,159 in the related Montana counties and 13,091 in Sheridan County, Wyoming. Unemployment levels in the basin are somewhat higher than the state average (7.8 percent as compared to 6.0 percent), primarily because of the higher than average unemployment rates in Big Horn and Rosebud counties. The Northern Cheyenne Reservation is located in Rosebud and Big Horn counties and, historically, there have been few employment opportunities on reservations.

Table 3-3 lists 1990 Census American Indian employment statistics for the Northern Cheyenne Reservation. As indicated, the unemployment rate for labor force participants was 31 percent, while the total proportion of non-working American Indians on the Northern Cheyenne Reservation (16 years old and over)

was 60 percent. Government agencies employed the majority of workers on the reservations, where 40 percent of the employed Northern Cheyenne worked in 1990.

TABLE 3-3
Tongue River Basin
Northern Cheyenne Reservation Employment Statistics (1990)

	NORTHERN CHEYENNE RESERVATION	
CATEGORY	NUMBER	PERCENT
Total American Indian Population - 16 years old and over	2,044	100.0
Not in Labor Force	850	40.4
In Labor Force	1,194	58.4
In Labor Force: Employed	819	68.6
In Labor Force: Unemployed	375	31.4
Total Unemployed	1,225	58.4
Employment/Occupation: Agriculture	26	3.2
Employment/Occupation: Private Industry	444	54.2
Employment/Occupation: Self-Employed	18	2.2
Employment/Occupation: Government	331	40.4

Source: U.S. Bureau of the Census 1990.

3.13.6.2 Income Trends

Employment in the Tongue River Basin is dominated by the government sector which has grown steadily over the past 20 years. Nearly one-fourth (23 percent) of basin earnings now come from the government sector. During the same time period, agricultural-related earnings in the basin declined markedly. In 1970, agricultural earnings comprised nearly one-third (29 percent) of all earnings in the basin. By 1985, basin agricultural earnings had declined to 1 percent of all earnings in the basin, before increasing to 10 percent by 1990.

In 1990, earnings in Sheridan County, Wyoming, totaled $237.3 million (U.S. Bureau of the Census 1994). Farm earnings in Sheridan County were $6.0 million in 1990, while government earnings accounted for $67.5 million and service and retail trade earnings totaled $54.3 million. Per capita income in Sheridan County ($22,559) was higher than both the Montana state average ($16,227) and the Montana Tongue River Basin average ($14,590) in 1992.

Two of the counties in the Tongue River Basin had per capita incomes that were less than the state average. In particular, Big Horn County had a 1993 per capita income of $10,040, which was 33 percent less

than the state average. One reason the per capita income in Big Horn County is lower than average is due to the high unemployment rate on both the Crow and Northern Cheyenne reservations, and the subsequent low median family income of American Indians. In 1990, the median family income of American Indians on the Crow Reservation was $14,031 compared to the basin median of $26,720 and the state median of $28,044. A similar situation exists in Rosebud County with the Northern Cheyenne Reservation, however the per capita income levels in Rosebud County are buoyed by the higher than average salaries paid at the mines and power plants located in the county.

3.13.6.3 Tongue River Basin Agricultural Economy

Farm-related employment in the four Montana counties that comprise the Tongue River Basin accounted for 13.5 percent of total employment in the basin during the period 1989-91 (**see Table 3-4**). This proportion was 50 percent higher than the 1979-81 statewide average of 8.6 percent. Basin farm employment increased slightly between 1979-81 and 1989-91, while statewide agricultural employment increased by 4.5 percent. Farm employment in the Tongue River Basin accounted for 7.0 percent of total statewide farm employment during 1979-81 and 6.7 percent during 1989-91.

Farm-related income in the Tongue River Basin averaged about 7 percent of total personal income in the basin during the period 1989-1991. This proportion was about the same as the average percentage reported from 1979-1981. Farm income in the basin declined slightly between 1980 and 1990. Most of this decline is attributable to factors such as drought and depressed farm prices in the late-1980s.

Agricultural sales in the Tongue River Basin averaged $163.2 million per year during the 1989-91 period, or about 9 percent of total agricultural sales in Montana. During 1989-91, livestock sales in the basin totaled $125.2 million and comprised three-fourths of total basin agricultural sales. Crop sales averaged $38.0 million and accounted for 23 percent of the basin's agricultural sales.

3.13.6.4 Public Sector Fiscal Conditions

The sectors of Montana's economy are taxed in a different manner and at varying rates. Sources for local government revenues in the Tongue River Basin are principally related to the property taxation of land, machinery, utilities, and the production of oil, gas, and coal. Rosebud County has four coal-fired electrical generating plants located near Colstrip, which account for nearly two-thirds of the property taxable valuation in the county. In addition, Rosebud and Big Horn counties tax the equipment used to mine coal, accounting for about 20 to 25 percent of property taxable valuation in the counties. Big Horn and Rosebud counties also receive local property tax revenues from production taxes on oil, gas, and coal. The production taxes received are distributed to local governments within the county based on prior mill levy levels associated with each government, including school districts.

TABLE 3-4
Tongue River Basin
Agriculture Economic Baseline Data

CATEGORY	AVERAGE 1979-81	AVERAGE 1989-91	PERCENT CHANGE	PERCENT OF STATE	
				1979-81	1989-91
Total Employment	18,830	18,285	-2.9	4.8	4.3
Farm Employment	2,470	2,472	0.1	7.0	6.7
Percent of Total	13.1%	13.5%			
Total Personal Income ($000)	$500,530	$489,144	-2.3	9.6	7.1
Farm Income ($000)	$ 37,214	$ 35,745	-3.9	13.1	7.1
Percent of Total	7.4%	7.3%			
Total Ag Sales ($000)	$227,162	$163,153	-28.2	9.6	9.2
Livestock Sales	$172,924	$125,166	-27.6	13.1	12.1
Percent of Total	76.1%	76.7%			
Crop Sales	$ 54,238	$ 37,986	-30.0	5.2	9.2
Percent of Total	23.9%	23.3%			

Note: All dollar amounts expressed in terms of 1990 dollars

Source: U.S. Bureau of the Census 1994.

The State of Montana also receives severance taxes from the production of coal in the Tongue River Basin. Through Fiscal Year 1993, state government had collected over $1.1 billion in taxes from coal production in the Tongue River Basin (Office of Legislative Fiscal Analyst 1993). At present, the state annually receives about $13.7 million in general fund taxes, $18.0 in trust fund revenues, and $6.6 million in other revenues from coal production.

The importance of agricultural property taxable valuation in the basin varies between counties, and is much more important in the non-coal producing counties. **Table 3-5** lists the 1994 agricultural-related taxable values for irrigated and non-irrigated farm land in the four counties in the Tongue River Basin. In 1994, irrigated land in Montana (1.66 million acres) had an average assessed valuation of $214 per acre and a corresponding taxable valuation of $8.25 per acre (Montana Department of Revenue 1994). Non-irrigated farmland in Montana (48.8 million acres) was assessed at $66 per acre, or 70 percent less than irrigated land. In the Tongue River Basin, irrigated land accounts for less than 2 percent of the total acreage in the basin, and about 13 percent of the taxable valuation related to agricultural land.

TABLE 3-5
Tongue River Basin
Agricultural Land Taxable Valuation (1994)

CATEGORY	IRRIGATED LAND		NON-IRRIGATED LAND	
	ACRES	TAXABLE VALUE ($00)	ACRES	TAXABLE VALUE ($000)
Big Horn County	40,898	505	1,435,102	3,055
Custer County	25,319	321	1,808623	1,867
Powder River County	8,035	37	1,327,510	1,812
Rosebud County	27,480	332	2,348,908	2,571
Tongue River Basin	**101,732**	**$1,195**	**6,920,143**	**$9,305**

Source: Montana Department of Revenue 1993.

3.14 TRANSPORTATION

The reservoir is accessed by Secondary Highway 314 and County Road No. 380 (see **figures 2-3 and 3-6**). An unsurfaced road, hereinafter referred to as East Shore Road, begins at County Road No. 380 at the west end of the dam, crosses the dam, and continues south along the east side of the reservoir to access several cabin sites.

3.14.1 Local Roads

County Road No. 380 begins at Secondary Highway 314 just west of the central portion of the reservoir, continues to the dam and to its junction with Secondary Highway 566 at Four Mile Creek (see **Figure 3-6**). The length of the road, from Secondary Highway 314 to the dam, is about 8.5 miles. The roadway is surfaced with a thin layer of gravel and is maintained by Big Horn County. The roadway includes four horizontal curves with a design speed of less than 20 MPH, seven horizontal curves with a design speed of less than 30 MPH, and five horizontal curves with a design speed of less than 40 MPH. There is one section of road near the dam and three additional shorter sections totaling 0.2 mile where vertical grades are about 10 percent and approximately 0.1 mile where grades are 13 percent. All other grades on the roadway are less than 8 percent. Sight distance is less than desirable in some areas. Traffic volumes on this roadway are shown on **Figure 3-6**.

East Shore Road is about 3 miles long and is an unimproved, one-lane road with a few informal turnouts. It is rough and not well maintained. The roadway includes many horizontal curves with a design speed of less than 20 MPH, steep vertical grades approaching 20 percent in some areas, and poor sight distance. Traffic on this roadway is estimated to be less than 10 vehicles per day with almost no large truck traffic.

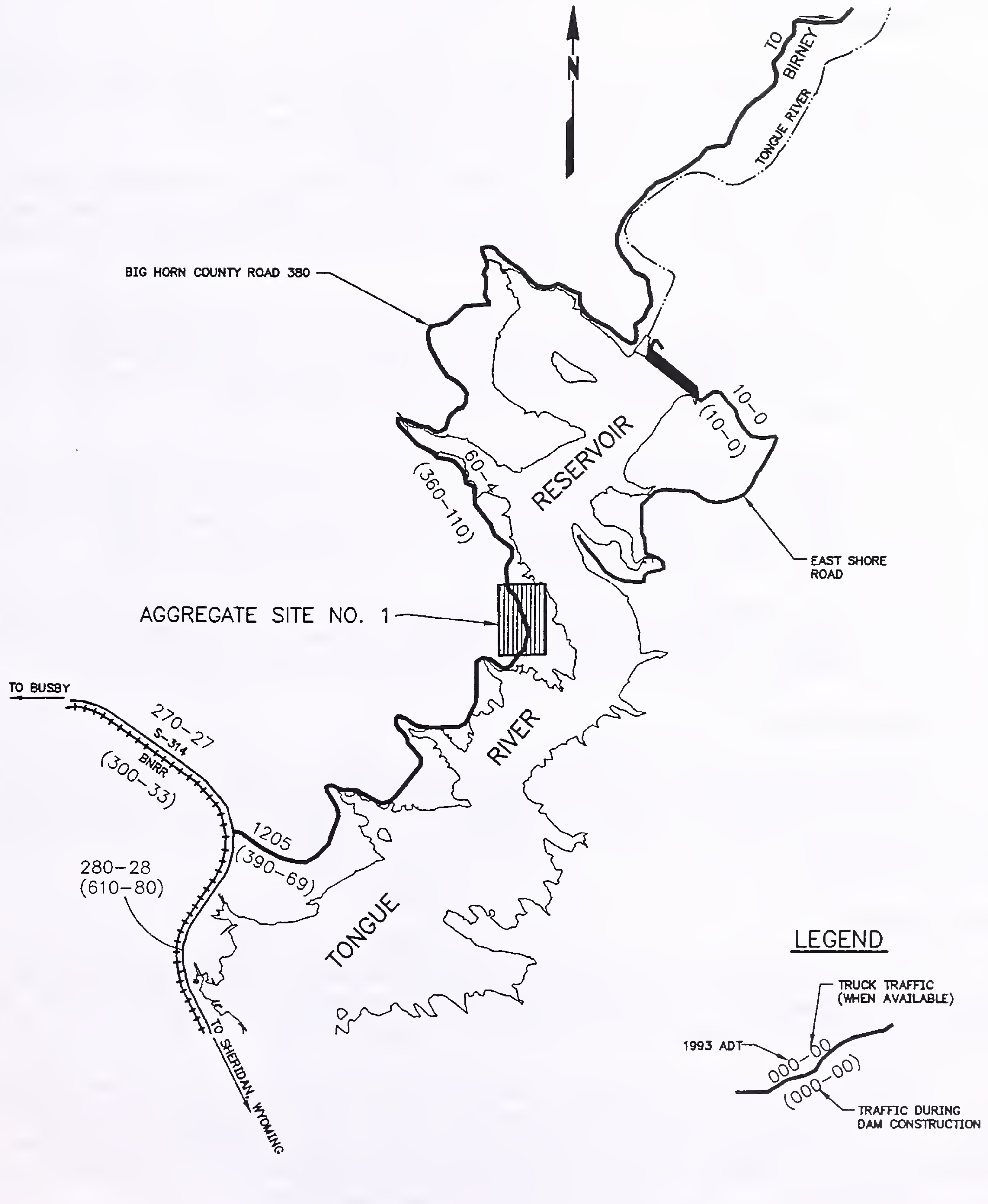


FIGURE 3–6

EXISTING LOCAL ROADS AND TRAFFIC VOLUMES

3.14.2 Secondary Highways

Several secondary highways exist in the project area. These roads are eligible for state and federal funding for construction and are maintained by the counties. They are functionally classified as rural collector roads. Secondary highways in the project area are shown on **Figure 3-7** and include:

- Secondary Highway 338 (S-338), from I-90 near Sheridan to the Montana/Wyoming line. This section of roadway is approximately 15 miles long and is a two-lane roadway with an asphalt paved surface, recently reconstructed with adequate shoulder width. S-338 is located several miles south of the reservoir.

- Secondary Highway 314 (S-314), from the north terminus of S-338 at the Montana/Wyoming border to U.S. Highway 212 near Busby. This section of roadway is approximately 44 miles long and is two-lane with an asphalt paved surface ranging from 28 to 31 feet wide. S-314 parallels the west side of the reservoir for approximately 5 miles.

- Secondary Highway 484 (S-484), from S-314 near the south end of the reservoir to U.S. Highway 212 just east of Ashland. This predominantly gravel roadway is approximately 0.2 miles from the reservoir at its closest point and is separated from the reservoir by a railroad spur. Portions of this road are not included in the secondary highway system.

- Secondary Highway 566 (S-566), from S-314 northeast of the reservoir to Birney. This section of roadway is approximately 52 miles long and is two-lane with a gravel surface ranging from 24 to 28 feet wide. This roadway is several miles north of the dam.

3.14.3 Off-Road Travel

Substantial off-road travel occurs in the project area, particularly along the northwest shores of the reservoir in the recreation areas. Recreationists, ranchers, and others use the area, traveling in a variety of on- and off-road vehicles. There are many areas where two-track paths have evolved as a result of frequent motor-vehicle travel.

3.14.4 Railroads

Decker and Spring Creek coal mines are served by a Burlington Northern (BN) branch line that extends from the mines south into Wyoming to connect with the BN mainline from Huntley, Montana. This branch line is well-built and maintained and has a 30 MPH speed limit.

An average of about 15.4 million tons, or about 163,000 carloads, of coal per year were carried on this branch line from the mines in each of the years 1988 to 1991. Other traffic on the line is minimal -- in 1991, non-coal freight included no carloads originating and only 12 carloads terminating at the mines. In addition to the extensive coal-loading facilities at each of the mines, sidings that exist at the West and the East Decker mines may allow unloading of up to 20 and 10 carloads, respectively.

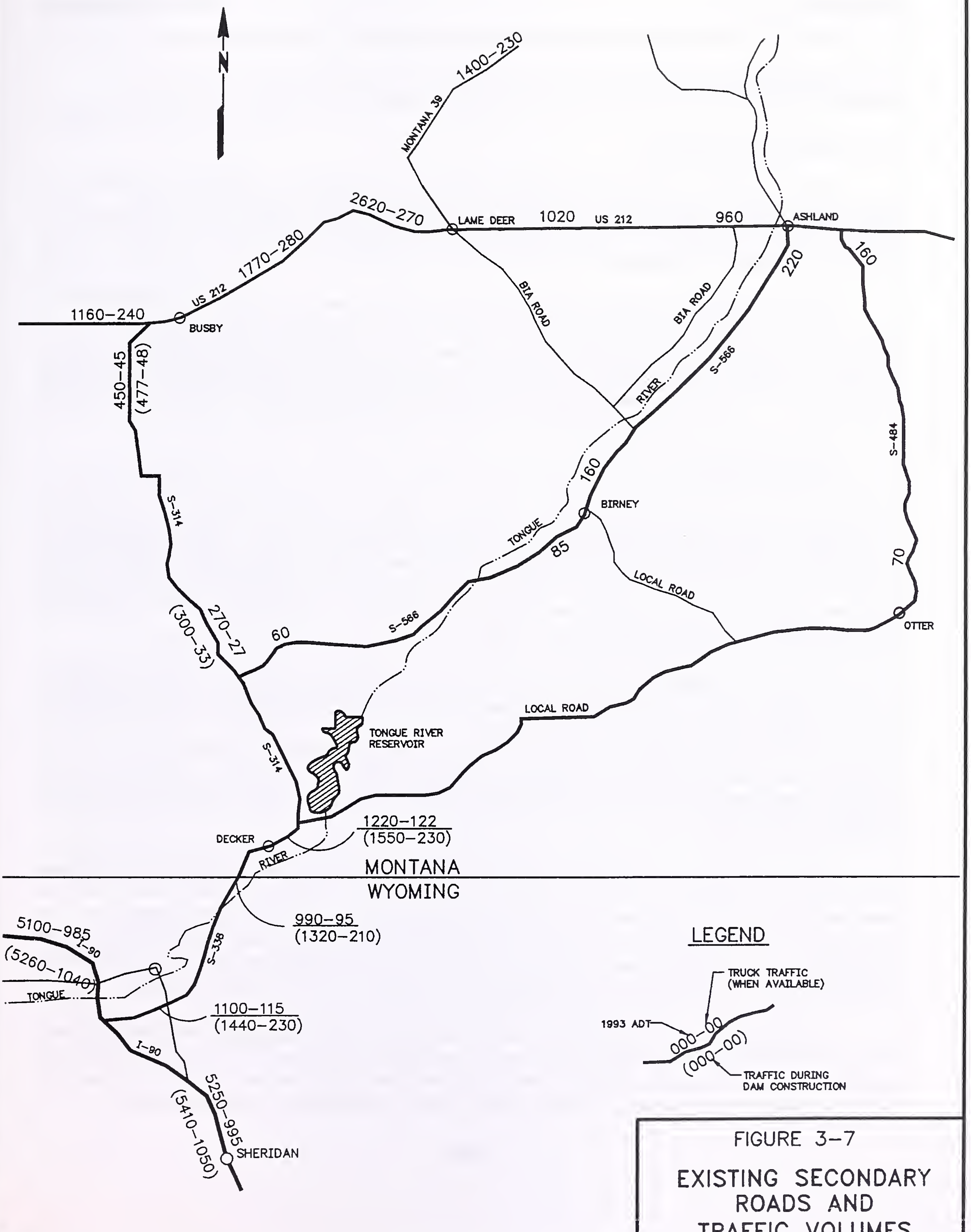


FIGURE 3–7

EXISTING SECONDARY ROADS AND TRAFFIC VOLUMES

3.15 RECREATION

3.15.1 Tongue River Reservoir

Use of Tongue River State Park has steadily increased at an average rate of 15 percent annually since 1989 (DFWP fee revenue records; John Little, Department of Fish, Wildlife and Parks, personal communication, February 11, 1994). These figures reflect an increase in the awareness and popularity of the park as a regional recreation resource.

Visitors to Tongue River State Park typically arrive from origination points within a 100-mile radius of the reservoir. This would include Sheridan, Johnson, and Campbell counties in Wyoming, and Yellowstone, Custer, Big Horn, Rosebud, Powder River, and Treasure counties in Montana. A study conducted in 1991 by USBR suggests that the park's effective recreation season extends from May 15 to September 15. The state park currently receives an estimated 550,000 total visitor hours annually. A full description of the recreational opportunities in the study area is presented below.

3.15.1.1 Fishing

The Tongue River Reservoir supports substantial angler use. Estimates of annual use were 17,270 angler days in 1991 and 24,572 angler days in 1993 (Montana Department of Fish, Wildlife and Parks 1991 and 1993). The Tongue River Reservoir is host to 11 warm-water game/sport fish species. DFWP's 1993 Creel Survey suggests that smallmouth bass, walleye, and crappie are the most popular species among anglers (Montana Department of Fish, Wildlife and Parks 1994; Phillip Stewart, Department of Fish, Wildlife and Parks, personal communication, February 11, 1994).

The reservoir's limited depth and fluctuating water levels combine with the region's warm summer seasons to make conditions unsuitable for maintenance of a viable cold-water fishery -- despite the limited presence of rainbow and brown trout (P. Stewart, pers. comm., February 11, 1994). Cooler-water releases from the reservoir help to maintain a limited cold-water habitat immediately downstream from the existing spillway. Two thousand 7-to-8-inch rainbow trout are planted in the area each year. Although not widely recognized, this effort provides anglers a rare cold-water fishing opportunity within the immediate area of the Tongue River Reservoir.

Thirty-six percent of angler use on the reservoir was from a combination of shore and ice fishing according to the 1993 Creel Census on the Tongue River Reservoir. Tongue River State Park on the west shore, and the dam facility on the north shore, provide a majority of the public shore-fishing opportunities on the reservoir. The east shore and southern one-third of the reservoir receive occasional use from private landowners and trespass fishermen, but rarely are used in comparison to the west and north shores. Public access is restricted because of private ownership, mine development, and geographic constraints.

A majority of the reservoir's angler use (64 percent) is from motorized and non-motorized watercraft. Nearly all of the reservoir's navigable surface area is available for public use when water levels are at their maximum elevation. When water levels are low, some areas, especially at the southern tip of the reservoir, are not accessible by boat because of shallow depths, submerged vegetation, and subsurface debris.

The 1993 Creel Census estimates show that nearly half of the annual fishing pressure occurred in the months of May and June. Montana anglers making up 60 percent of the fishing pressure and Wyoming anglers comprise most of the remainder.

3.15.1.2 Boating

Motorized. The Tongue River Reservoir has no restrictions on the size or types of boats and/or motors. This means the reservoir is host to a number of different types of recreational boats including jet boats, jet skis, wave runners, pontoon boats, ski boats, fishing boats, speed boats, pleasure craft, and motorized rafts and canoes.

A recreation survey conducted in 1993 by DNRC found that nearly 90 percent of the visitors to the Tongue River Reservoir participated in some level of boating activity, making boating the most common recreational activity on the reservoir. The reservoir currently experiences an estimated 175,000 boating hours annually. Most of this activity occurs between April 1st and September 30th.

Boating opportunities are dispersed uniformly across the northern two-thirds of the reservoir. The DFWP has reported concerns with traffic congestion in the narrow straits off Sand Point (John Little, Department of Fish, Wildlife and Parks, October 11-13, 1993). Reduced water levels to elevation 3,420 feet expose large flats on the tip of Sand Point and significantly narrow the passage for boats. The gradually sloping bench that forms Sand Point is also found intermittently around the reservoir's eastern perimeter. Large expanses of these exposed beaches are also found at Rattlesnake, PeeWee, and Campers points. They often contain stumps and submerged debris that pose hazards to boaters when the water level is low.

Two designated launch ramps are located at Campers Point. The ramps, one gravel and one concrete, experience significant traffic between May and July and are the subject of public concern regarding ramp congestion. Ramp congestion and the associated launch and loading delays have resulted in some launch activity directly from the shore in many of the park's "rustic" areas.

No public docking facilities are available on the reservoir. About five privately operated boat slips are located at Campers Point Marina and are available for marina-related activities. Because of the limited availability of docking areas and the expanse of public access, recreationists often prefer to anchor off-shore or dock directly on the beach near their respective land-based activity (e.g., day use site, campsite). However, public concern has been voiced regarding the inconvenience and hazards of insufficient docking facilities at the launch sites (ramps).

Non-Motorized. Non-motorized canoes, fishing boats, rafts, and sailboats also use the reservoir. Although less abundant, these vessels typically avoid the more populous areas on the reservoir and spend more time along the shore and in small coves where high-speed activity such as waterskiing and jet skiing is less frequent. Because of the reservoir's lack of secluded areas (i.e., small bays, backwater sloughs), frequent interaction between motorized and non-motorized boaters has caused some conflict between the two groups. This situation has been aggravated in recent years by reduced water levels.

3.15.1.3 Camping

Tongue River State Park is one of only four state parks (Tongue River, Cooney, Hell Creek, Medicine Rocks) in Montana exclusively hosting rustic camping opportunities. The rustic nature of the park is defined by four key elements: 1) non-designated camp sites, 2) minimal water supply -- central pump, 3) central trash receptacles, and 4) occasional fire rings (Doug Monger, Department of Fish, Wildlife and Parks, personal communication, December 8, 1993). Although abundant camp sites are forged within the park each year by the public, only a few are formally developed by the existence of fire rings and picnic shelters. **Table 3-6** provides a detailed breakdown of existing facilities at Tongue River State Park.

The undesignated use of the park's available camping areas resulted in significant deterioration of the natural vegetation and soil stability in the accessible areas near the reservoir. The lack of formal (signed and restricted) shoreline and campsite access routes provides for random access to most areas of Rattlesnake, Campers, PeeWee, and Sand points. Limited camping and water access occurs along the remainder of the reservoir's west shore where topography, vegetation, and landownership allow.

Informal camps are established in restricted, or privately held areas, such as Boathouse Point. However, the areas most intensively used for camping at the reservoir are in the state park at Rattlesnake, Campers, PeeWee, and Sand points **(see figures 2-3 and 2-12)**. Level of use is in direct proportion to the availability of site facilities (e.g., restrooms, shelters), park road access, and proximity to water. Less intensive use occurs in the Neck and Cormorant Bay areas, and the fishing access site immediately downstream from the dam. DNRC (1993) found that nearly 83 percent of the visitors to the Tongue River Reservoir camped, making it the second most common recreational activity on the reservoir after boating.

The Tongue River State Park's rustic nature makes the exact delineation of camping areas very difficult. Since a majority of the areas between the county road and the water's edge are relatively level and experience some level of camping activity, the study team evaluated the number of acres available for camping on each of the areas described below (**Figure 2-3 and Table 3-7**). This calculation served as a baseline to identify the opportunities lost or gained in the Chapter 4 analysis of environmental consequences.

3.15.1.4 Day Use

DNRC (1993) found that roughly 17 percent of the visitors to the Tongue River Reservoir used the site as a day use area only. Day use activities include picnicking, hiking, swimming, sun bathing, wildlife viewing, fishing, boating, and photography. Day users typically visit the area from within a 60-mile radius, including Sheridan and Buffalo, Wyoming and Hardin, Montana.

Most of the day-use activity occurs within Tongue River State Park and most accessible areas on the west and north ends of the reservoir. Occasional use in privately held areas is evident, although no exact information is available on the amount and seasonality of use.

TABLE 3-6
Facilities Inventory - Tongue River State Park and Fishing Access Site

FACILITY	RATTLE-SNAKE POINT	CAMPER POINT	PEE WEE POINT	SAND POINT	NECK BAY	CORMORANT BAY	DOWN STREAM SITE	TOTAL NUMBER
Picnic shelters		4		2			3	9
Single toilets		3		2			2	9
Double toilets	1	4	1					3
Handicap accessible toilets		1		1				2
Picnic tables	9	49	24	22	4	2	3	118
Trash cans with holders	7	12	14	8	4	2	7	54
Fire rings	7	8	13	6			3	38
Well, pump house, 2 hydrants		1						1
Gravel boat ramp		1						1
Concrete boat ramp		1						1
Pay phone		1						1
3,200 square foot parking lot (gravel)		1						1

Source: Montana Department of Fish, Wildlife and Parks 1994.

TABLE 3-7
Acreage Available for Camping

CAMPING OPPORTUNITY	ACRES FROM EXISTING HIGH WATER LEVEL TO OLD COUNTY ROAD	ACRES FROM NORMAL ELEVATION (3,420 FEET) TO OLD ROAD
Rattlesnake Point	77	90
Campers Point	60	81
PeeWee Point	31	31
Sand Point	83	109
Neck Bay	32	39
North Shore	19	25

Source: Figures developed by MME Corp. 1994.

3.15.2 Regional Recreation

3.15.2.1 Fishing

Lakes and Reservoirs. Eleven cold-water lakes or reservoirs are present within a 100-mile radius of the project; three in Montana and eight in Wyoming. All 11 host rainbow trout with a majority also containing cutthroat, brook, and brown trout. Four of the 11 lakes also host warm-water fisheries including crappie, yellow perch, channel catfish, sauger, walleye, and largemouth bass.

All 11 cold-water lakes and reservoirs are popular daily attractions for local recreationists. Nine serve as destination points for vacationing and overnight users. Each of the subject lakes receives moderate to heavy use by local and regional anglers. The cold-water lakes located along the Big Horn front and in the alpine regions are often inaccessible in the winter due to heavy snow and inclement road and/or trail conditions.

Ten warm-water lakes or reservoirs lie within the study area (excluding Tongue River Reservoir) -- four in Montana and six in Wyoming. None of the ten host all 11 warm-water species found in Tongue River Reservoir. Four of the ten lakes also host cold-water fisheries including brown, brook, and rainbow trout, as well as burbot.

All ten warm-water lakes and reservoirs in the study area are popular daily attractions for local recreationists. Approximately six are destination points for vacationing and overnight users. Each of the subject lakes receives moderate to heavy use by local and regional anglers.

Rivers and Streams. Eighteen cold-water rivers or streams are present in the study area -- two in Montana and 16 in Wyoming (including the Tongue River in Wyoming and its north and south forks). Sixteen

of the cold-water rivers or streams in the study area host rainbow trout. Other species actively angled include brook, brown, and cutthroat trout, mountain whitefish, grayling, and burbot.

The lower reaches of all 18 rivers and streams are accessible by vehicle in the summer, with limited accessibility in the winter. Upper reaches of many rivers and streams may not be accessible by vehicle, but can be reached with proper knowledge of trails and conditions.

All 18 cold-water rivers or streams in the study area are popular daily attractions for local recreationists. Depending on the particular reach, these rivers/streams receive minimal to heavy use by local and regional anglers.

Seven warm-water rivers or streams lie within the study area -- four in Montana and three in Wyoming. None of the seven warm-water rivers or streams host all the warm-water species found in the Tongue River below the reservoir.

All seven warm-water rivers or streams in the study area are popular daily attractions for local recreationists. Most of them are accessible year-round and receive moderate to heavy use by local and regional anglers.

3.15.2.2 Boating

Lakes and Reservoirs. Only three lakes in the recreational study area are substantial enough to host the types of motorized boating activity present on Tongue River Reservoir. Big Horn Lake, Yellowtail Afterbay, and Lake DeSmet are popular boating lakes with little to no restrictions on size or type of motors or activities. Each lies within 70 miles of the Tongue River Reservoir. Keyhole Reservoir, Buffalo Bill Reservoir, and Fort Peck Lake are also popular recreational sites near the study area that serve as boating destinations for recreationists. The three water bodies are 120, 150, and 180 miles away, respectively.

Many opportunities exist within the study area for non-motorized boating activity. However, Big Horn Lake, Yellowtail Afterbay, and Lake De Smet are the only three within the study area that are similar in size and character to Tongue River Reservoir. Smaller water bodies include Castle Rock Lake, Gillette Fishing Lake, Sibley Lake, Lake Elmo, Lake Josephine, and Park Reservoir.

Rivers and Streams. Motorized boating opportunities in the region are limited. Five rivers similar to the Tongue River are found within the recreation study area. The Powder, Big Horn (above and below Yellowtail Dam), Little Big Horn, Shoshone, and Yellowstone rivers all host similar motorized boating opportunities at points throughout their reaches. Although water quality, turbidity, volume, and flow vary between these rivers, each would serve as an adequate alternative to motorized recreation on the Tongue River.

Non-motorized boating opportunities similar in character to those currently found on the Tongue River in Montana are more abundant than those for motorized. In general, non-motorized opportunities are the same as those identified for motorized recreationists, but also include many tributaries of each.

3.15.2.3 Camping

The only camping opportunities within the study area that offer water and are similar in character to the Tongue River State Park are those found on Big Horn Lake, Lake DeSmet, and Keyhole Reservoir. None of these areas offer the rustic camping opportunity exhibited at the Tongue River State Park.

For those camping along the river below the dam, opportunities of similar character in the study area include developed and rustic campsites along the Powder, Big Horn (above and below Yellowtail Dam), Little Big Horn, Shoshone, Greybull, and Yellowstone rivers. Clear, Crazy Woman, Little Powder, Pumpkin, and Rosebud creeks also offer camping opportunities yet lack the volume of water that contributes to the recreational experience along the Tongue River.

3.15.2.4 Day Use

Day uses are available at many locations in the study area. Those similar in character to the Tongue River Reservoir are those found on Big Horn Lake, Lake DeSmet, and Keyhole Reservoir.

Opportunities for day use activities along the rivers of similar character in the study area are found along the Powder, Big Horn (above and below Yellowtail Dam), Little Big Horn, Shoshone, Greybull, and Yellowstone rivers. Clear, Crazy Woman, Little Powder, Pumpkin, and Rosebud creeks also offer day use opportunities yet lack the volume of water that contributes to the recreational experience along the Tongue River.

3.16 LAND USE AND OWNERSHIP

Land adjacent to the reservoir is currently open space, supporting crop and livestock production, and recreational uses. Most land constituting the shoreline of the reservoir is held by DNRC, acquired by the State Water Conservation Board for purposes of reservoir operation when the original dam was built. Where DNRC does not own land adjacent to the reservoir, the agency has acquired flood easements or other legal agreements from public agencies or private landowners for reservoir operation.

Landownership around the reservoir is shown on **Figure 3-8.** Aside from DNRC, Department of State Lands (DSL), the Bureau of Land Management (BLM), Northern Cheyenne Tribe, and private ownership is held here. BLM, DSL, and the Tribe maintain livestock leases on their lands (Sally Hampton, Bureau of Land Management, personal communication, December 6, 1994).

Tongue River State Park is located on land owned by DNRC. Park facilities are described under Recreation. In addition, a marina run by a concessionaire and serving the recreating public is located about the mid-point of the west side of the reservoir on land owned by DNRC.

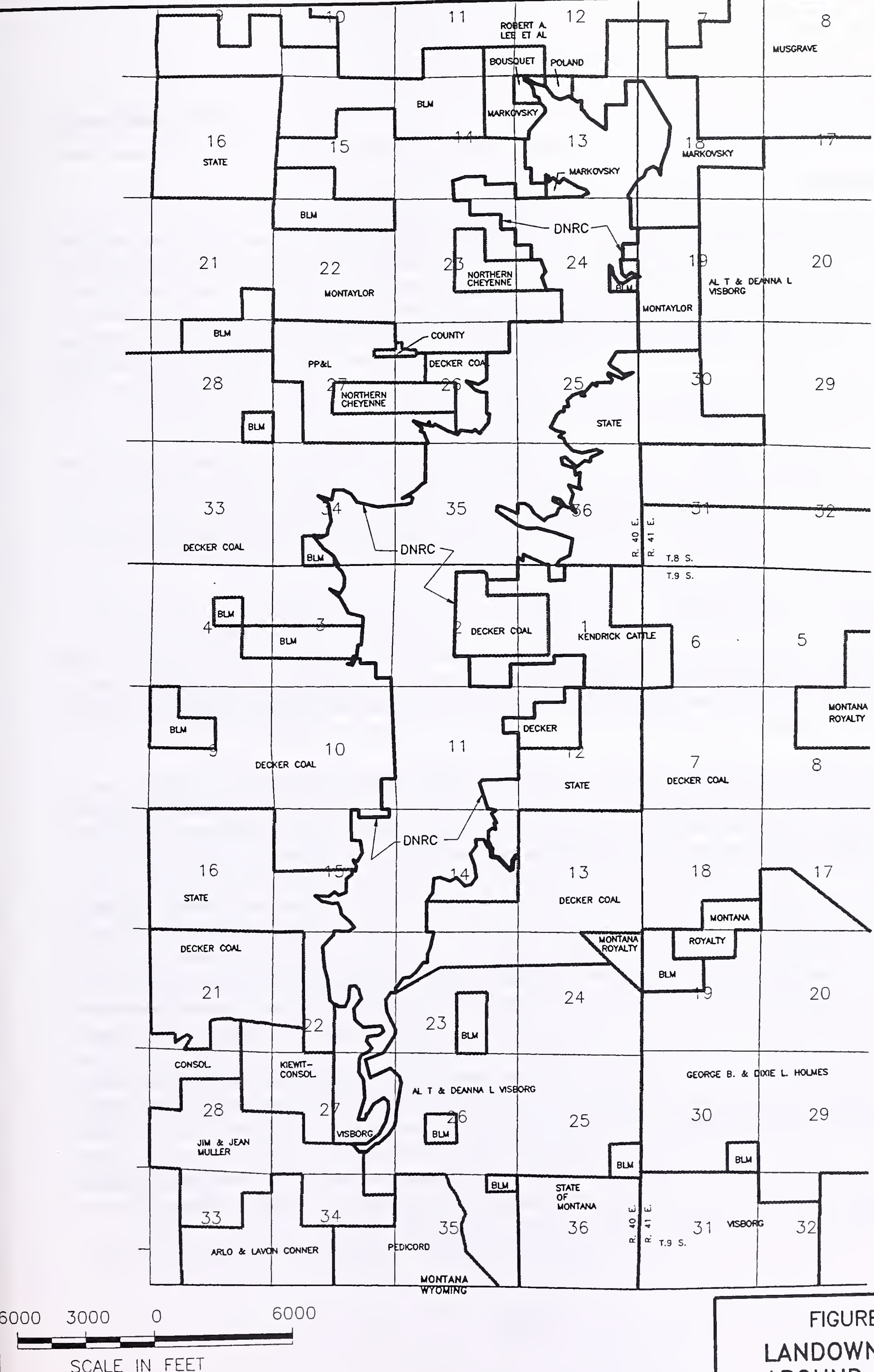


FIGURE 3–8
LANDOWNERSHIP AROUND TONGUE RIVER RESERVOIR

3.16.1 Coal Mines

Decker Coal Company owns and operates coal mines on land adjacent to Tongue River Reservoir (see Figure 2-3). These are open-pit mines which use large equipment to remove overburden and expose buried coal seams. Removal of water from open pit coal mines is a necessary operation. West Decker Mine is located immediately to the west of Montana Highway 314 near the west shore of the reservoir and has been in operation since 1972. Mining has been ongoing in a series of long horseshoe-shaped outer pits that have progressed from east to west. The West Decker mine includes a railroad coal load-out facility and siding. The West Decker Mine is being extended to the north. Current plans indicate that the north extension of West Decker Mine will use the railroad coal load-out and equipment maintenance facilities at the West Decker Mine.

The East Decker Mine is located directly east of the West Decker mine on the east shore of the reservoir. The East Decker Mine began operations in the late 1970s and consists of north and south pits that have progressed from west to east. The north pit is currently inactive. The facilities at the mine include a railroad coal load-out, equipment maintenance shops, and most of the Decker Coal Company offices.

3.17 CULTURAL RESOURCES

Cultural resources are the physical remains of peoples' past use of an area, as well as certain locations where no physical remains are present. Cultural resources include sites, buildings, structures, districts, objects and landscapes. In addition to containing a record of past human use or belief, they can symbolize peoples' continuing relationship to the area.

Every ethnic group interprets cultural resources in terms of their group's traditional cultural values and beliefs. Indians in southeastern Montana tend to view cultural resources as part of an interrelated system that has both physical and spiritual characteristics that must be respected. Euro-Americans in the area tend to view cultural resources primarily as sources of information in their ongoing study of the past.

These two world views result in different definitions of cultural resources and different evaluations of which cultural resources are important or significant. For example, lithic scatters are defined by archaeologists working in the western scientific tradition as a location containing evidence of past tool making/use. Archaeologists regard a lithic site as important or significant if it contains information about how tools were made or used in the past. Northern Cheyenne, Crow, Northern Arapaho, Eastern Shoshone and Minneconjous traditionalists, on the other hand, view lithic scatters as evidence that past people found a location to be both physically and spiritually compatible. No exact physical boundaries are placed on the site. Instead it is seen as a node in a network of interrelationships between people and their physical/spiritual environment. The site's significance to the Indians lies not only in that it marks a place of past compatibility, but also in the fact that it signals that people today continue in this relationship and hence must respect the area.

Ethnic groups with an ongoing interest in the cultural resources of the Tongue River project area are the Northern Cheyenne, Crow, and Teton Sioux (primarily, the Minneconjous) and Euro-Americans (Peterson, Ibanez, and Brownell 1995).

Southeastern Montana, including the Tongue River area, is deceptively easy to characterize in terms of cultural resources. It was inhabited throughout prehistory (the last 12,000 years) by semi-nomadic hunters and gatherers. During the last 4,000 years the primary focus of hunting was the buffalo. The dominant prehistoric site type in the area is the surface lithic scatter. Southeastern Montana has a high density and diversity of readily available rock types (e.g., porcellanite, cherts, quartzites, Tongue River silicified sediment, silicified marl) that were viewed as desirable for tool making by prehistoric peoples. There are probably more lithic procurement sites (small scale quarries) in southeastern Montana than in any other similar sized area in North America (Deaver and Deaver 1988).

Other common prehistoric site types found in the area are stone feature sites, primarily tipi rings and cairns (rock piles). Rare prehistoric site types found in the area include pictograph/petroglyph sites, bison kill/processing sites, vision quest sites, rock shelters, and sites containing ceramics (Deaver and Deaver 1988).

In the last 200 years of recorded history, the Crow, Eastern Shoshone, Northern Cheyenne, Northern Arapaho, and various bands of the Teton Sioux camped, hunted, and battled in the project area. Also during the last 200 years, Euro-Americans moved into the area. Their primary strategy of adaptation has been ranching/farming. As in other areas of eastern Montana, many attempts were made to engage in small scale (160 to 640-acre) ranching/farming but most were unsuccessful. These attempts were responsible for producing the most common historic site type in the area -- the homestead. Other historic site types found in the general project area include dumps, public buildings, rural towns, railroad grade, monument localities (graves, commemorative markers) and rock art sites (historic graffiti). The relatively low forage productivity of the area that limited the size and distribution of the prehistoric hunters and gatherers has also limited the success of the historic ranching adaptation to those who can control extensive amounts of grass.

In 1992 and 1994, archaeologists inventoried the following areas: the 400 acres to be inundated by the proposed 4-foot raise of the reservoir water level, road reroutes, and potential wetland and campground development areas (see **Figure 2-3**, cultural resources survey area). Also inspected for cultural resources were the two parcels of land that were transferred from BLM stewardship to the Northern Cheyenne Tribe, specific historic locations related to original dam construction and potential staging, borrow, and waste areas. A total of 3,500 acres were inventoried in 1992 (Peterson, Ibanez, and Brownell 1995). An additional 80 acres were examined in 1994.

Members of the Northern Cheyenne Cultural Commission inspected selected sites for traditional cultural concerns and inventoried the entire project area for ethnobotanical concerns (Peterson, Ibanez, and Brownell 1995; Aaberg and Tallbull 1993).

Fifty-six sites (41 Indian and 15 Euro-American) were documented (Peterson, Ibanez, and Brownell 1995). Nineteen of the sites had been recorded previously. Of the 19 previously recorded sites, two (sites 24BH0591 and 24BH2349) had been recommended as eligible to the National Register of Historic Places (NRHP). Site 24BH0591 is a large tipi-ring site, which although eligible has not been listed on the NRHP. Site 24BH2349, the Lee Homestead, was listed on the NRHP in 1981.

Eight of the previously recorded sites had been recommended as ineligible to the NRHP. The earlier studies of the remaining nine previously recorded sites made no eligibility recommendations.

The 41 Indian sites in the proposed project area include 30 lithic scatters, three lithic procurement sites, three tipi ring sites, four other stone feature sites, and one bison kill. The 15 Euro-American sites include eight farmsteads, four dumps, one community, one railroad grade, and one dam.

Site 24BH0591, a tipi ring site, was identified as being possibly associated with Chief Two Moons of the Northern Cheyenne Tribe and his band. Further it was noted that the general site location is associated with spirit beings recognized by the Northern Cheyenne. Site 24BH2613, a bison kill/processing site is viewed as having sacred/spiritual significance by the Northern Cheyenne. The Crow as well as the Northern Cheyenne have requested that they be kept involved with any further work at the bison kill site. Site 24BH2317 is a stone ring site recommended as eligible to the NRHP due to its information potential.

Site 24BH2271, the Shreve Homestead, is recommended as eligible to the NRHP due to its strong association with early settlement in the area, its historic buildings which illustrate early construction methods, and because it has the potential to yield information about daily life in the historic period. The Tongue River Dam is recommended as eligible due to its strong association with the development of state water conservation projects in Montana in the 1930s. Site 24BH2601 is the remains of a workers' town associated with the construction of the dam. It is recommended as eligible due to its information potential.

Sixty-two plant species were identified that have ethnic significance and ongoing use for the Northern Cheyenne (Aaberg and Tallbull 1993). None are restricted to habitat below elevation 3,428.4 feet, the proposed high water mark for the modified reservoir. Generally, these plants are widely distributed around the Tongue River Reservoir. Most of these species are easily accessible in the general area.

3.18 NOISE

Noise can be characterized as unwanted, unpleasant sound. It can cause hearing losses, interfere with speech communication and the performance of complex tasks, and disturb sleep. Noise may be either intermittent or continuous, steady, or impulsive. It can result from a broad range of sources and frequencies bleeding together, or from one specific sound. The human response to noise is diverse and varies with the type of noise, time of day, and sensitivity of the individual. The range of magnitude from the faintest to the loudest sound humans can hear is so large that sound pressure is expressed on a logarithmic scale in units called decibels (dBA). To simulate how humans hear various frequencies of sounds, the overall frequency spectrum is measured as A-weighted decibels (dBA). Loudness, compared to physical sound measurement, refers to how individual humans subjectively judge a sound.

A change in sound level of 10 dBA is usually perceived by the average person as a doubling (or halving) of the sound's loudness. This is true for loud and soft sounds. For example, a gas lawn mower at 100 feet would be about twice as loud as heavy traffic at 300 feet (see **Figure 3-9**). Noisy urban daytime sounds would be perceived as being about four times as loud as heavy traffic at 300 feet.

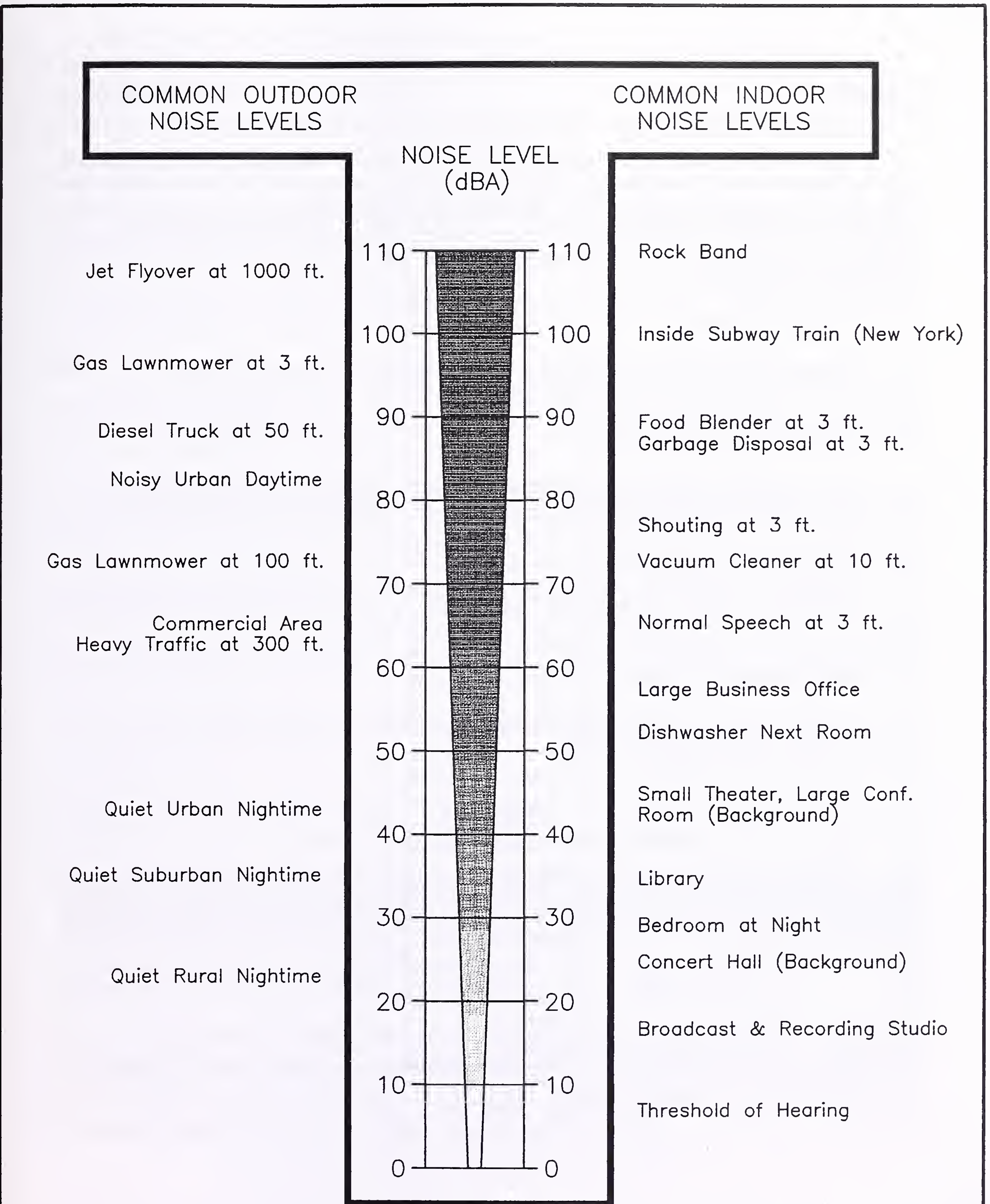


FIGURE 3-9

COMPARATIVE NOISE LEVELS

Noise levels from traffic depend on volume, speed, percentage of trucks, topography, vegetation, and distance from the roadway to receptor. Generally, an increase in volume or speed will increase traffic noise levels. For a line source such as roadway traffic, noise levels will decrease 3 dBA over hard ground (concrete, pavement) or 4.5 dBA over soft ground (grass) for every doubling of distance between the roadway and receptor. For a point source such as stationary construction equipment, noise levels will decrease 6 dBA for every doubling of distance.

3.18.1 Roads and Highways

Estimated existing Leq noise levels along several roadways in the project area are shown on **Table 3-8.** (Leq is a sound level equivalent to expected average noise.)

3.18.2 Construction Staging Area

It is estimated that existing Leq noise levels at the site of the proposed construction project range from 35 to 40 dBA. These are considered normal outdoor background noise levels in an open space setting.

3.18.3 Tongue River State Park

Existing noise levels within the Tongue River State Park are estimated to be approximately 35 to 40 dBA.

3.18.4 Sheridan Residential Area

Existing noise levels in the residential areas near the railroad sidings in Sheridan, Wyoming, are estimated to be approximately 55 to 60 dBA.

TABLE 3-8
Existing Noise Levels (in dBA) Along Roadways

ROADWAY	LOCATION	DISTANCE FROM CENTERLINE (feet)			
		50	100	150	200
S-314	Decker	65	62	60	59
S-314	South of Road 380	59	56	54	53
Road 380	Between S-314 and Aggregate Site No. 1	47	44	42	41
Road 380	Between Aggregate Site No. 1 and Dam	45	42	41	39

Source: Estimated by Morrison-Maierle/CSSA 1994.

3.19 VISUAL RESOURCES

The project area is located in the Tongue River Valley, formed when the river and its tributaries eroded through parts of the Fort Union Formation. Tongue River flows from the mountains onto an open agricultural valley until reaching the reservoir. Just upstream of the river's entry into the reservoir, the largely undisturbed landscape is broken by the East and West Decker coal mines on either side of the river (**see Figure 3-10**). These mines have disturbed a substantial area adjacent to the upper reservoir, serve as a major contrast to the surrounding landscape, and are visible from the upper reservoir.

Topography surrounding the reservoir ranges from the flat river valley and benches to surrounding steep and eroded terrain (**see figures 3-10 and 3-11**). Montana Highway 314, County Road No. 380, and the BN spur line are located within a short distance of the reservoir. These features have been built using typical cut-and-fill construction methods, some sections of which are visible from the shoreline.

The reservoir is about 8 miles long and 1 mile wide (**see Figure 3-12**) with depths up to 90 feet. Reservoir margin ranges from shallow, barren mudflats at the upper end to gently sloping silt, sand, and gravel beaches to several areas with steep, rocky slopes. The reservoir margin includes a variety of vegetation ranging from relatively dry grassland and shrubland, punctuated by small stands of juniper and ponderosa pine, to riparian forest with a typical diversity of cottonwood, green ash, and box elder and a diversity of deciduous shrubs and grasses. The reservoir margin is a distinct visual feature with largely barren slopes formed by the reservoir and resulting wave action meeting the natural topography and vegetation at about the spillway elevation (**see Figure 3-13**). During periods of low flow into the reservoir and during drawdowns, the barren margins between the water level and vegetation expand considerably, reducing the scenic quality of the area.

The existing dam site spans about 1,800 feet across the stream valley at a height of 91 feet. The dam is prominent when viewed from the stream valley immediately below (**see Figure 3-14**). However, public access to this viewpoint is limited and the visibility of the dam is limited to about 0.5 mile downstream. The dam is less prominent when viewed from a boat on the reservoir. Viewers can see the dam's riprapped rock embankment above the reservoir water level (**see Figure 3-13**). The spillway is most visible when viewed from the west abutment or the downstream channel near the Tongue River Canyon fishing access site. From this viewpoint, one can see the concrete spillway chute and stilling basin. The spillway is not highly visible when viewed from the reservoir; views are limited to the abutment walls and the spillway crest when the reservoir is drawn down. The most visible feature of the low level outlet works is the gate house located near the centerline of the west end of the dam embankment. The intake structure is normally submerged in the reservoir and the outlet structure exits along the centerline of the spillway chute near the toe. The historic Lee Homestead structures are directly north of the dam embankment (**see Figure 3-14**).

Typical views of Tongue River State Park are of grassy flats, bisected by an informal network of roadways and occasionally interrupted by vegetation and/or park facilities, such as picnic tables (**see Figure 3-15**). Pike Pond is a 33-acre impoundment immediately adjacent to the southwest side of the reservoir, but separated from it by a dike (**see Figure 3-15**). The pond is not readily distinguishable from the surrounding landscape, partially because it does not support much high-growing vegetation.

Looking North with West Decker Coal Mine in Foreground

FIGURE 3–10

OBLIQUE AERIAL PHOTOGRAPH OF UPPER RESERVOIR AREA

Looking South with Tongue River Dam in Foreground

FIGURE 3-11

OBLIQUE AERIAL PHOTOGRAPH OF LOWER RESERVOIR AREA

From the reservoir, the river flows northeast from the project about 190 miles to its mouth on the Yellowstone River at Miles City. The valley immediately below the dam is confined to a width of 0.25 mile with steep terrain on either side. The Tongue River Canyon fishing access site is on a bench on the west side of the river, about 0.25 mile from the toe of the dam. This site, the existing waste area, and County Road No. 380 constitute about 5 acres of disturbed area in the viewshed.

→ N ←

NOTE

WATER LEVEL IN THIS PHOTO IS APPROX.
AT MAXIMUM RESERVOIR POOL LEVEL OF 3424.4

PHOTO COMPOSITED FROM 7/8/92 FLIGHT BY HORIZONS, INC.

3333 0 3333 6666 9999

APPROX. SCALE IN FEET

FIGURE 3-12

1992 AERIAL PHOTOGRAPH OF RESERVOIR NEAR ELEVATION 3424 FEET

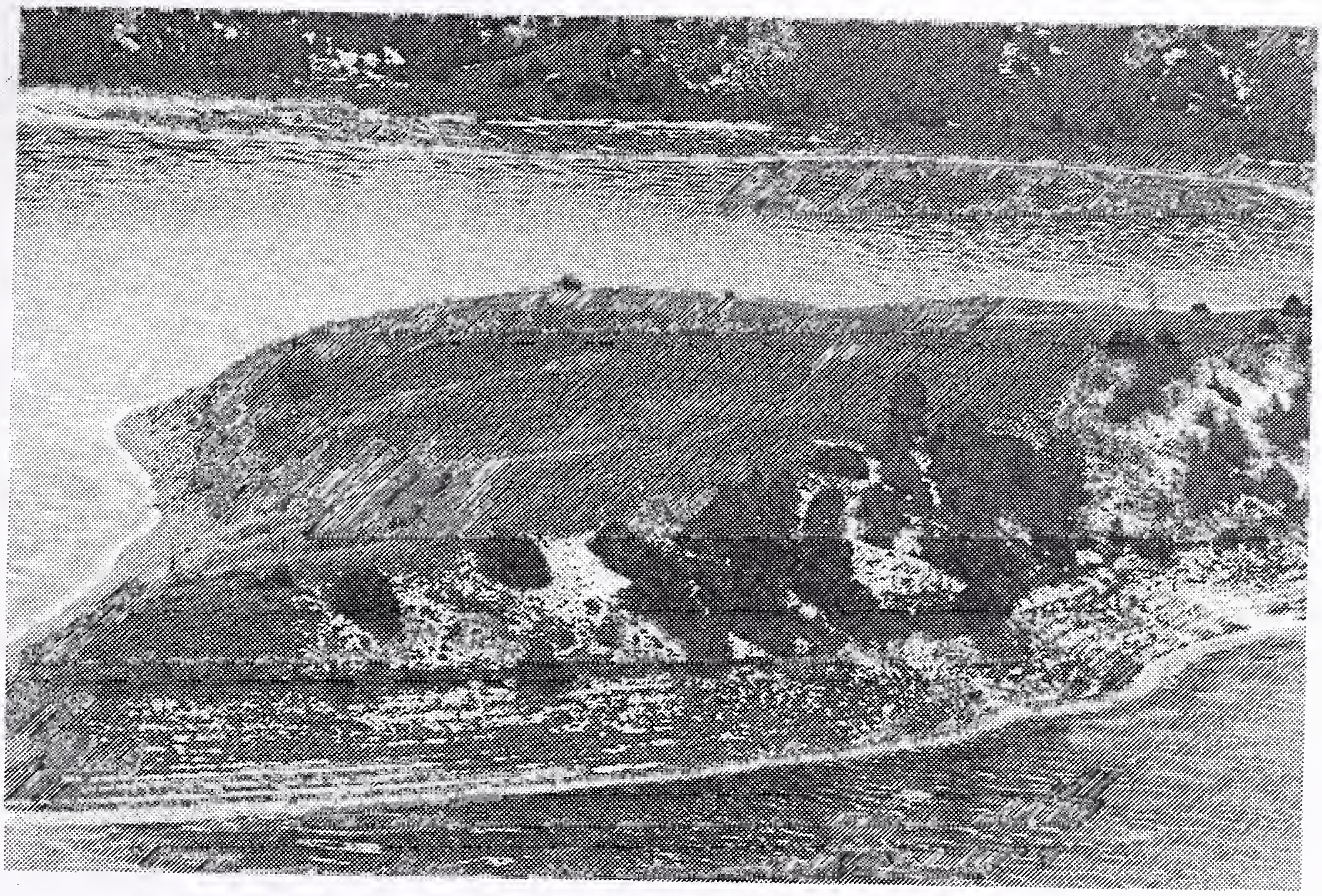


PHOTO SHOWING TYPICAL RESERVOIR MARGIN

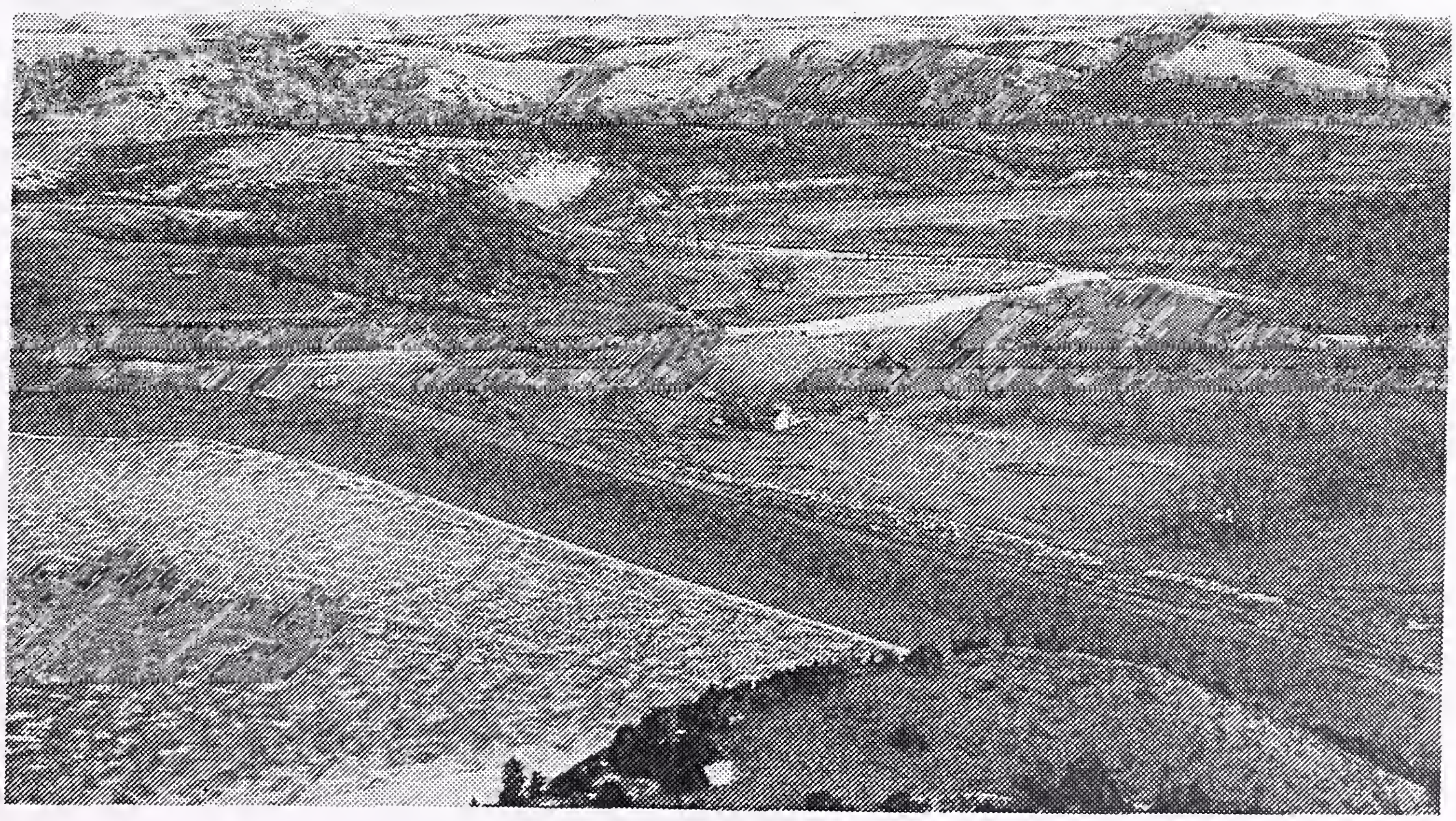


PHOTO SHOWING UPSTREAM DAM FACE

FIGURE 3–13

PHOTOGRAPHS OF TYPICAL RESERVOIR MARGIN & UPSTREAM DAM FACE

THIS PAGE INTENTIONALLY LEFT BLANK

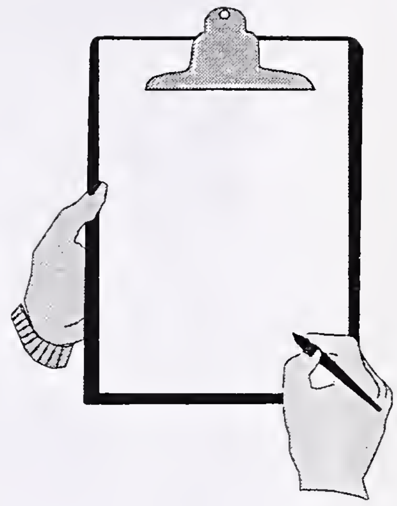


PHOTO SHOWING HISTORIC LEE HOMESTEAD STRUCTURES DOWNSTREAM OF DAM

PHOTO SHOWING DOWNSTREAM DAM FACE

FIGURE 3–14

PHOTOGRAPHS OF HISTORIC LEE HOMESTEAD AND DOWNSTREAM DAM FACE

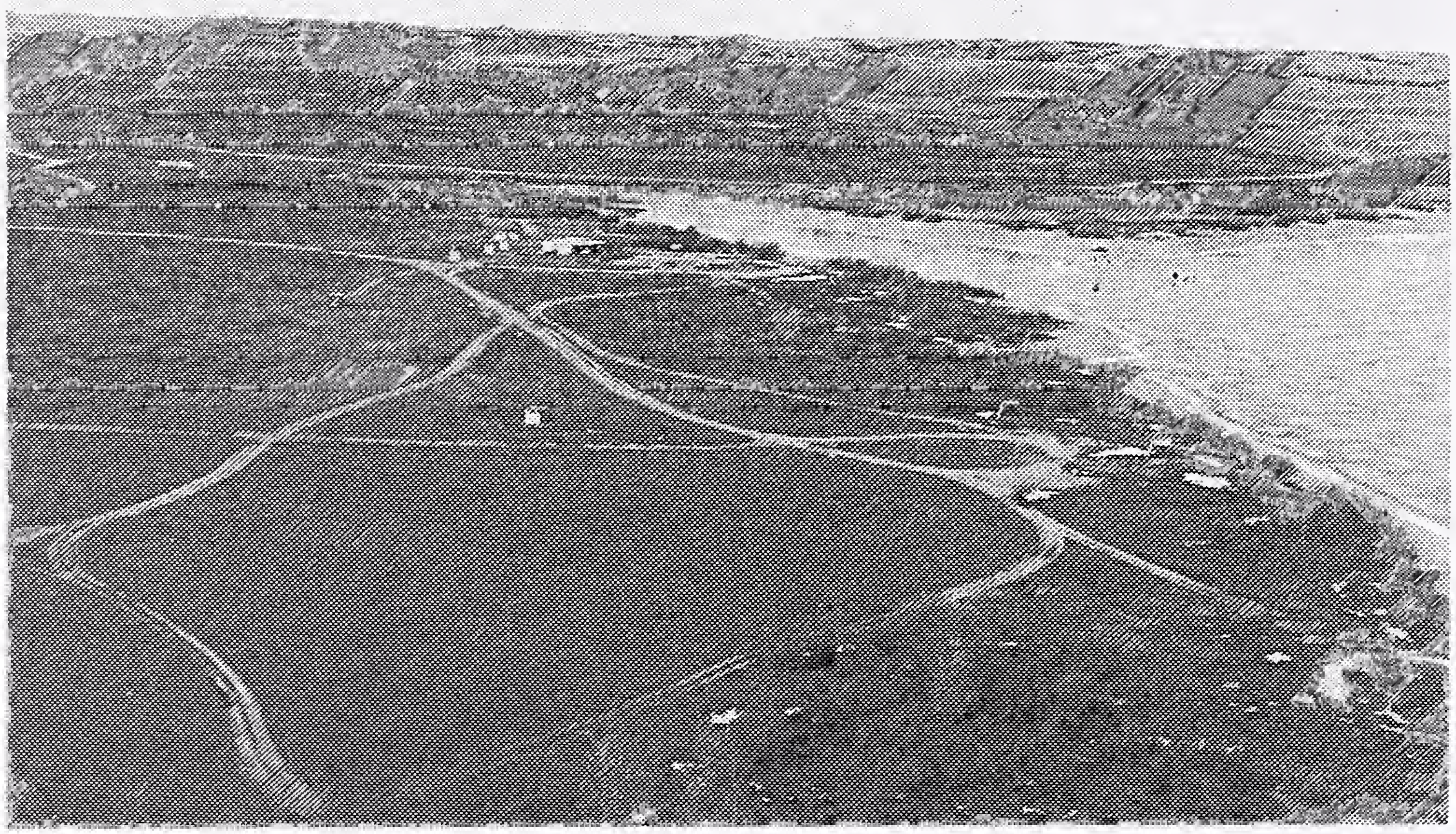


PHOTO SHOWING TYPICAL TONGUE RIVER STATE PARK CAMPING AREA

PHOTO SHOWING THE PIKE POND (RESERVOIR LOW AT TIME OF PHOTO)

FIGURE 3–15

PHOTOGRAPHS OF TONGUE RIVER STATE PARK CAMP AREA & PIKE POND AREA

CHAPTER 4 ENVIRONMENTAL CONSEQUENCES

4.1 INTRODUCTION

This chapter contains the project sponsors' analysis of probable impacts to the human environment that would result from rehabilitation of the Tongue River Dam and related water rights settlement. Impacts of the fulfillment of Settlement Act water rights are discussed in a separate and final section of this chapter because the timing, extent, and nature of Tribal use of water is unknown at this time. The impacts from fish and wildlife habitat enhancement activities are also discussed at the end of this chapter because the timing, extent, and specific nature of projects are unknown at this time. This chapter also contains the analysis of probable cumulative impacts that would result from adding the proposed project alternatives to other existing and reasonably foreseeable activities in the Tongue River Basin and near Sheridan, Wyoming.

To perform the impact analysis contained in this chapter, certain assumptions were made, and reasonably foreseeable activities described. These are for the purpose of this analysis only. They are not intended to be the final projection of future activities that may or may not materialize in the area over the next 5 years. Where no impacts exist under a specific heading (e.g., cumulative effects), no discussion is provided.

4.1.1 Assumptions

- Project-related road construction would be initiated in spring 1996. Spillway construction would begin in spring 1997.

- Reclamation would be initiated when an area was no longer needed for project activities.

- Local short-term impacts of the project are those that would occur from preconstruction through reclamation and mitigation; until about the year 2000. Long-term impacts of the project are those that would persist beyond completion of the project. For construction and operation activities considered in the cumulative analysis, short-term impacts are those that occur during the term of the respective activities. Long-term impacts are those that would persist beyond the terms of these activities.

- An irreversible and irretrievable commitment of resources would occur when resources were either consumed, committed, or lost as a result of the project. The commitment of a resource would be *irreversible* if the project started a "process" (chemical, biological, and/or physical) that could not be stopped. As a result, the resource, or its productivity, and/or its utility would be consumed, committed, or lost forever.

  Commitment of a resource would be considered *irretrievable* when the project directly eliminated the resource, its productivity, and/or its utility for the life of the project.

- Qualitative terms are used to describe anticipated magnitude of impacts and, where appropriate, anticipated importance of impacts to the human environment. The terms "major," "moderate," "minor," and "negligible" describe magnitude. "Significant,"

"potential to become significant," and "insignificant" describe importance. Impacts are assumed to be insignificant unless identified otherwise.

- Cumulative impacts are defined as collective impacts of the project when considered in conjunction with other past, present, and reasonably foreseeable activities. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

- The geographical limits for the analysis of probable impacts in this EIS primarily encompass the reservoir and adjacent shoreline and Tongue River to about 0.5 mile downstream. Where a study area was broader for a particular resource, it is described below.

Hydrology. Tongue River Basin, including the Tongue River and its tributaries from the Montana-Wyoming border to Miles City, is the study area for hydrology.

Aquatics/Fisheries. Tongue River Reservoir and Tongue River from the reservoir to Miles City is the river reach that would be monitored for fisheries mitigation. Since effects from the proposed action, other than run-of-river flows and reduced reservoir volumes, likely would be measurable only during a 2-week period in late October of 1997, the primary study area has been limited to the reservoir and river to Four Mile Creek.

Biological Diversity. The study area for biological diversity is the Tongue River Basin.

Socioeconomics. For social conditions, the study area includes the Northern Cheyenne Reservation and the communities of Ashland and Birney, Montana. For economic conditions, the study area includes the Tongue River Basin: Rosebud, Big Horn, Powder River, and Custer counties in Montana and Sheridan County, Wyoming.

Transportation. The study area for transportation is shown on **Figure 3-7**. It primarily includes all or portions of Interstate 90, Secondary Highways 314, 212, and 338, County Road No. 380, and East Shore Road. It also includes a possible rail load-out site and haul route in Sheridan, Wyoming.

Noise. The study area for noise is similar to that for transportation but also includes the reservoir areas that would be affected by construction activities and the town of Decker, Montana.

4.2 CLIMATE

4.2.1 Effects Common to the Action Alternatives

No measurable effect on the climate of the area would occur for either of the action alternatives. The microclimate immediately adjacent to the reservoir could be affected due to the increased surface area (during typical years) of the reservoir. This effect would be noticed by a minor moderation in temperature extremes around the reservoir. Impacts on the climate of the area from the action alternatives would be negligible in the short and long terms.

4.2.2 Effects From Alternative 3

Under Alternative 3, there would be no measurable effect on climate. Impacts on the climate of the area from the no-action alternative would be negligible in the short and long terms. In the event of dam failure, minor changes in the local microclimate could occur; greater fluctuations in temperature would be possible.

4.3 AIR QUALITY

4.3.1 Effects Common to the Action Alternatives

Air quality impacts from the action alternatives would include increased pollutants from construction and materials hauling, and from wind erosion of exposed mud flats. Air quality impacts would be minor and would be limited to the period of construction and reclamation.

Construction activities that would impact air quality include road construction, concrete batching, aggregate excavation and processing, site preparation for riprap, heavy construction equipment traffic and exhaust, and travel on unpaved roads. Construction activities would result in particulate and gaseous air pollutant emissions. Airborne particulates from road construction and improvements and resulting traffic on unpaved roads would be mitigated by using water trucks and/or calcium chloride, and periodic grading. Concrete batching and aggregate processing would be mitigated by water spray or other appropriate control measures. Dust from aggregate excavation and hauling would be controlled by watering. Exposed areas from the aggregate excavation and other disturbed areas would be reclaimed to minimize emissions of particulates. Gaseous emissions would result primarily from diesel and gasoline exhaust. These emissions include oxides of nitrogen, sulfur dioxide, carbon monoxide, and volatile organic compounds.

Construction work on the dam would result in a temporary exposure of beach or mud flat areas due to drawdown of the reservoir. Once exposed to the sun and wind, these areas could erode. Under high wind speeds, exposed mud flats can produce airborne particulates. However, once wind speeds subsided or precipitation occurred, particulate emissions would lessen and/or cease. Once the reservoir was filled to capacity, and until the Tribe developed its Settlement Act water right, seasonal fluctuations in water levels would be less than at present.

Once the reservoir was filled, the new elevation would flood some additional agricultural areas at the upper end of the reservoir. This could result in land exposure to wind erosion during periods of reservoir drawdown.

Construction activities and wind erosion would have a minor localized effect on area air quality. Within the immediate area of the construction work and heavy equipment traffic (including Tongue River State Park), elevated particulate and gaseous pollutant concentrations would occur. Particulate emissions generally are composed of large particulates that quickly settle out to the ground. Remaining fine particulates and gaseous pollutants would be transported downwind. As these pollutants traveled downwind, they would become dispersed and eventually removed through gravitational settling or rain washout. These effects could be minimized by the use of appropriate emission control measures and reducing the time period that disturbed or beach areas were exposed to wind and sun. There would be no measurable effect on the air quality of the Northern Cheyenne Reservation Class I area or the general ambient air quality of the area.

Air quality impacts could occur in the vicinity of the rail load-out facility and within a four-block residential area in Sheridan, Wyoming in the event that the Sheridan load-out were used for the transport of construction materials. The project sponsors intend to use the load-out at Sheridan only if transport of construction materials cannot be successfully negotiated at the Decker coal mines. If the Sheridan load-out were used, dust abatement efforts would be undertaken to avoid air quality impacts in Sheridan. Part of this mitigation effort would include the evaluation of air quality baseline data as a continuous means of gauging and evaluating the effectiveness of dust-control measures.

Indirect effects to air quality could result from increased recreationists' vehicle emissions if the area became more attractive to recreationists. Impacts on air quality from action alternatives would be negligible to minor in the short term and negligible in the long term.

4.3.2 Effects From Alternative 3

Under the no-action alternative, there would be no change in air pollutant concentrations or emissions. Impacts on air quality from the no-action alternative would be negligible in the short and long terms. However, a potential impact to air quality would occur should the dam fail. The failure could result in increased exposure of beach area and shorelines, which, when exposed to the sun and wind, could erode. In this case, impacts to local air quality could be minor to moderate. No measurable effect would occur at the Northern Cheyenne Reservation Class I area because of the prevailing wind direction.

4.3.3 Cumulative Effects

Cumulative air quality impacts could result from construction and operation of the Tongue River Railroad and possible activities at Decker coal mines. Should construction and reclamation work on the dam coincide with construction work on the proposed Tongue River Railroad, there would be a combined increase in air pollutant concentrations from particulates and gaseous pollutants.

Pollutant emissions from Decker coal mines include particulates, oxides of nitrogen, sulfur dioxide, carbon monoxide, and volatile organic compounds. However, the cumulative effects of these pollutants would

not exceed Montana or federal air quality standards and would be limited to the proposed 2-year dam construction and reclamation period; afterwards localized air quality impacts would be reduced considerably.

The cumulative impacts on air quality from action alternatives and coal mine emissions would be negligible to minor in the short term and negligible in the long term.

4.4 GEOLOGY

4.4.1 Effects Common to the Action Alternatives

4.4.1.1 Geologic Stability

Increased water levels as a result of increasing the height of the spillway crest would have the potential to reduce slope stability at various locations around the reservoir. There are existing slope failures and rock slides in parts of sections 13, 24, and 25, T8S, R40E. As water saturates soils at the base of slopes, it tends to make them more fluid, less cohesive, and less able to support overlying materials. Potential slope failure could effect reservoir capacity, and dam integrity (due to overtopping by a large wave created by a slide falling directly into the reservoir). Also, risk to human health and safety would exist if people were using a slide-prone area when failure occurred.

Slope failures and rock slides have a low probability of occurrence and depend on the characteristics of the overburden as well as the saturation process. There are no data supporting or refuting the conclusion that increased water levels in the reservoir would impact geologic stability. The slide area in Section 13 would be monitored in accordance with the Monitoring Plan (see Chapter 2, Proposed Mitigation and Monitoring).

Impacts to geologic stability (slope failures and rock slides) following increases in reservoir water levels would be negligible to minor over the short and long terms.

4.4.2 Effects From Alternative 3

Under the no-action alternative, water levels would remain as they have been historically and the impacts on the geologic stability would be negligible.

4.5 GEOTECHNICAL STABILITY

4.5.1 Effects Common to the Action Alternatives

Geotechnical stability of dam embankments is generally measured by factors of safety. A factor of safety in excess of minimum standards is presumed to be safe.

Both action alternatives would have equal stability ratings and would exceed commonly accepted design criteria stability safety factors (see **Table 4-1**). Impacts on geotechnical stability from action alternatives would be negligible in the short and long terms.

4.5.2 Effects From Alternative 3

The no-action alternative would maintain existing levels of geotechnical stability and the impacts would be negligible in the short and long terms.

TABLE 4-1
Factors of Safety for the Existing and Proposed Dam Embankment

LOADING CONDITION	EXISTING FACTOR OF SAFETY	FACTOR OF SAFETY WITH 4-FOOT INCREASE	MINIMUM ACCEPTABLE FACTOR OF SAFETY
Steady-state seepage downstream face	2.8	2.8	1.5
Steady-state seepage upstream face	2.8	2.8	1.5
Seismic with 0.02g acceleration	2.0	2.0	1.1
Rapid drawdown	2.2	2.2	1.3

Source: Department of Natural Resources and Conservation 1994.

4.6 SOILS

4.6.1 Effects Common to the Action Alternatives

4.6.1.1 Shoreline

Increased water levels as a result of increasing the height of the spillway crest would impact the reservoir shoreline. Higher water levels would expand the shoreline of the reservoir exposing new areas to saturation and wave action. Minor bank instability would occur until the shoreline reached its stable beach angle.

Current reservoir shoreline erosion was determined from infrared photographs. Approximately 11 miles of shoreline is undergoing erosion by wave action. The soils (mapping units) that characterize the eroding shoreline are described as having moderate to severe erosion hazards (Meshnick et al. 1971). With increased reservoir elevation, 14 miles of shoreline have the potential to erode based on physical comparisons of currently eroding areas.

The topography and composition of shoreline materials would stabilize over the long term and where Secondary Highway 314 has the potential to be impacted, placement of riprap or protective vegetation would be conducted in accordance with the proposed plan. Impacts to the reservoir shoreline from the increase in reservoir water levels would be minor to moderate over the short term and negligible over the long term.

4.6.1.2 Prime and Unique Agricultural Land

No "prime farmland" or "unique" soils have been identified in areas proposed for project construction activities or in areas impacted by the completed project. Approximately 41 acres of irrigated land, designated as "prime if irrigated," would be impacted by increased reservoir water levels. This is less than 5 percent of the soils between the reservoir and the state line that could be designated "prime if irrigated". Impacts to "prime if irrigated" farmland from project activities would be minor in the short and long terms.

4.6.1.3 Soil Productivity in Areas of Project-Related Surface Disturbance

Surface disturbances related to proposed project construction and associated activities have the potential to change the productivity of disturbed soils on up to 151 acres. As a result of stripping and stockpiling, soil structure and horizonation would be altered. Soil compaction may result from material laydown, temporary facility construction, and vehicle operation. Soil loss from wind and water erosion may occur on unprotected areas.

Construction and reclamation plans include methods to minimize the negative impacts to soil productivity. The final reclamation plan would include soil salvage and redistribution methods. These methods would maintain soil structure and minimize the mixing of surface and subsurface soil horizons. Surface horizon organic matter and essential nutrient concentrations would be maintained as much as possible. Soil compaction should be alleviated by tillage. While soil micro-organism populations, fertility, and viable plant reproductive structures (e.g., seeds, shoots, bulbs) would be reduced by topsoil stockpiling, they would rejuvenate within a few years with proper reseeding and mulching. The soil erosion hazard after reclamation may be reduced by maintenance that includes mulching, access control, appropriate application of soil replacement, seedbed preparation, and general reclamation techniques. Impacts to soil productivity in areas of project-related surface disturbance would be moderate to major over the short term and minor over the long term.

4.6.1.4 Relocation of State Park

Surface disturbances related to the relocation of the State Park facilities (see Recreation) would change the productivity of the soils due to compaction and location of various facilities. The relocation of access roads, recreation sites, and concession-related facilities would commit this land and underlying soils to designated recreational use. Impacts from relocation of State Park facilities on soil productivity and commitment of soil resources to permanent recreational use would be minor in the short and long terms. For further discussion of impacts on soils, see Implementation of Fish and Wildlife Habitat Enhancement Features.

4.6.2 Effects From Alternative 3

Under the no-action alternative, shoreline erosion will continue at existing rates. No additional land would be inundated. Soil productivities would remain at current levels. No "prime if irrigated" farmland would be affected and no soil resources would be irreversibly committed to other uses. The impacts to soils associated with the no-action alternative would be negligible. However, under dam failure, impacts to soils and soil productivity from erosion and deposition would be major and significant.

4.7 HYDROLOGY

4.7.1 Effects Common to the Action Alternatives

4.7.1.1 Reservoir Operations

Both action alternatives would produce a 4-foot increase in spillway crest elevation, allowing the maximum controlled reservoir storage to increase from about 67,000 acre-feet to about 80,000 acre-feet. The reservoir surface area and storage capacity are shown on **Table 4-2** and **figures 4-1 to 4-3.** Increased reservoir storage combined with a fully operational spillway would produce changes in reservoir operations when compared to historic operation. Operation of the reservoir would be similar for both action alternatives. In general, the reservoir would be operated within an established reservoir operations plan with first priority given to meeting up to 60,000 acre-feet of demands (**see Table 4-3**). If these demands were not called for, any remaining portion would be left in the reservoir.

An interim reservoir operations plan has been developed by, and is on file at, DNRC. A five-member advisory committee would be established following construction of the project to develop the final reservoir operations plan. The members would include representatives from the State of Montana, the Tongue River Water Users Association, the Northern Cheyenne Tribe, the United States, and a fifth member to be selected by the other four.

Key components of the interim reservoir operations plan include:

- a maintenance program to clear the reservoir, dam, and spillway of floating debris;
- as much as practical, maintaining the reservoir elevation and downstream releases during winter months at consistent levels. This would allow for flood storage during high runoff events, minimize ice jams and pressures associated with higher reservoir elevations, minimize impacts on the reservoir and downstream fisheries, and minimize exposure of the mud flats at the south end of the reservoir; and
- goals aimed at satisfying existing contract water rights and the Northern Cheyenne Water Rights Compact. Fish and wildlife habitat/enhancement, recreation opportunities, and other secondary goals would be satisfied depending on the availability of water.

Initially, with the 4-foot raise in the spillway crest elevation, Tongue River Reservoir elevations and contents generally would be higher than those that have occurred historically. However, seasonal reservoir fluctuations would occur as water was stored in the spring and released in the summer for downstream consumptive uses. **Figures 4-4 and 4-5** compare reservoir elevations and contents for two hypothetical postconstruction scenarios to those that have occurred historically during a typical (median) year. During drought years, greater reservoir fluctuations would occur than those indicated in **figures 4-4 and 4-5**. In fact, it is foreseeable that even with the increased reservoir storage capacity, the reservoir could still drop to very low levels (dead storage, or 1,500 acre-feet of capacity) during extreme droughts. Expected reservoir

elevations and storage by month, including information regarding elevation fluctuations and figures for wet and drought years, are indicated on **tables E-4 and E-5 in Appendix E.**

Ultimately, reservoir elevations and contents would be determined by: 1) how the reservoir is operated, 2) how much reserved water the Tribe develops for consumptive uses, and 3) how much additional water is developed by Wyoming. Water development by both the Tribe and Wyoming is discussed in greater detail under Fulfillment of Settlement Act Water Rights in the Tongue River Basin.

TABLE 4-2
Elevation vs. Surface Area and Storage Capacity

ELEVATION	SURFACE AREA	STORAGE CAPACITY
feet	acres	acre-feet
3,354.4	0	0
3,374.4	217	1,473
3,380.0	375	3,123
3,390.0	683	3,123
3,400.0	1,136	17,645
3,405.0	1,380	25,373
3,415.0	1,639	31,613
3,415.0	2,189	41,183
3,380.0	2,754	53,541
3,424.4	3,198	66,638
3,424.4	3,612	80,254
3,442.2	4,740	130,000

Source: GeoResearch, Inc. 1991.

TABLE 4-3
Water Rights and Contracts in Tongue River Reservoir

WATER USER	AMOUNT, acre-feet
Tongue River Water Users Association (contract water)	32,500
Northern Cheyenne Tribe (existing contract water)	7,500
Northern Cheyenne Tribe (new compact water)	up to 20,000
TOTAL	up to 60,000

Source: GeoResearch 1991; Department of Natural Resources and Conservation 1981.

Median reservoir storage for the existing condition is 28,000 acre-feet at elevation 3,407 feet. This condition is largely influenced by the restricted reservoir operating criteria allowing 20,000 acre-feet of storage until the peak of the runoff season has passed, and a reduced maximum allowable reservoir storage of 40,000 acre-feet. These criteria are in effect due to the condition of the existing spillway.

Median reservoir content for the action alternatives and no development of Wyoming water rights would be 69,000 acre-feet at elevation 3,426 feet. Median reservoir content for the action alternatives and full development of Wyoming water rights would be 47,000 acre-feet at elevation 3,423 feet.

Future reservoir operations shown on figures 4-4 and 4-5 and tables E-4 and E-5 in Appendix E demonstrate that both action alternatives, during typical years, would hold the reservoir at a higher elevation when compared to the existing condition. Direct and indirect impacts to air quality, fisheries, and aquatics in the reservoir, recreation, vegetation, geology, and soils from raised water levels are discussed in the appropriate sections. For further discussion of impacts on hydrology, see Implementation of Fish and Wildlife Habitat Enhancement Features. Impacts on periodic reservoir elevations and median reservoir storage from action alternatives would be major and significant in the short term and major, beneficial, and significant in the long term.

4.7.1.2 Downstream Releases

During Construction. In general, during construction, downstream releases would be about equal to the inflow to the reservoir due to reduced available storage. The exception of a one-time short-term (less than 2 weeks) release of not less than 25 cfs would occur during late fall of 1997 to allow for installation of a bypass if it were used under the RCC alternative. Downstream releases would supply water (decreed water rights) to decreed water users that normally would be available without using water stored in the reservoir.

NOTES:

WATER LEVEL IN THIS PHOTO APPROXIMATES POTENTIAL RESERVOIR POOL LEVEL OF 3428.4 TAKEN OURING FLOOO OF MAY 1978

PHOTO COMPOSITED FROM 5/19/78 FLIGHT BY MONTANA DEPT. OF TRANSPORTATION, PHOTO SERVICES

FIGURE 4–1

1978 AERIAL PHOTOGRAPH OF RESERVOIR NEAR ELEVATION 3428 FEET

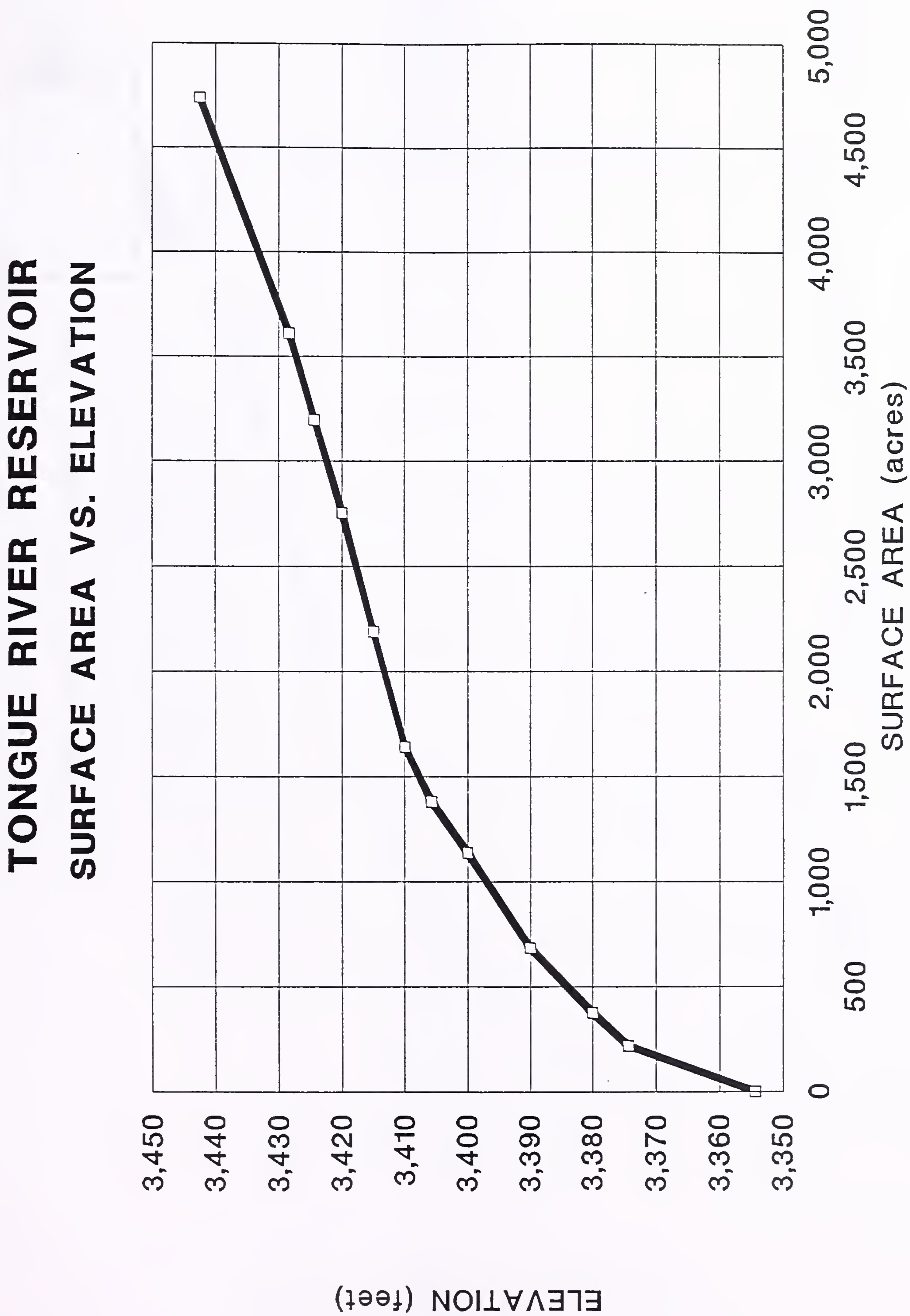
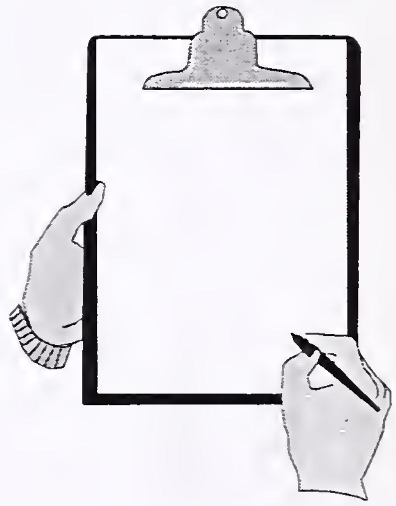


FIGURE 4-2

RESERVOIR SURFACE AREA vs. ELEVATION

THIS PAGE INTENTIONALLY LEFT BLANK



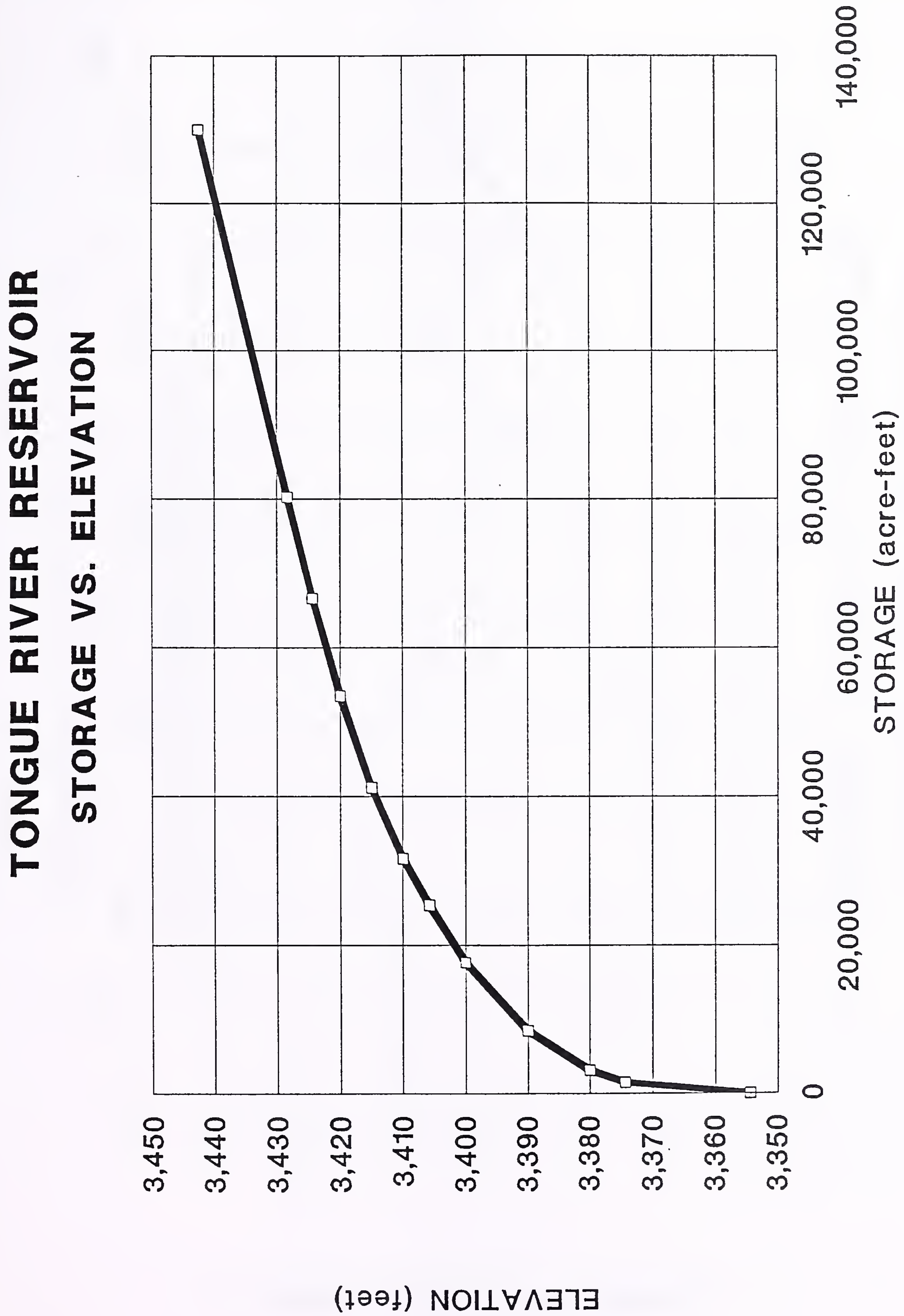


FIGURE 4–3

RESERVOIR STORAGE
vs. ELEVATION

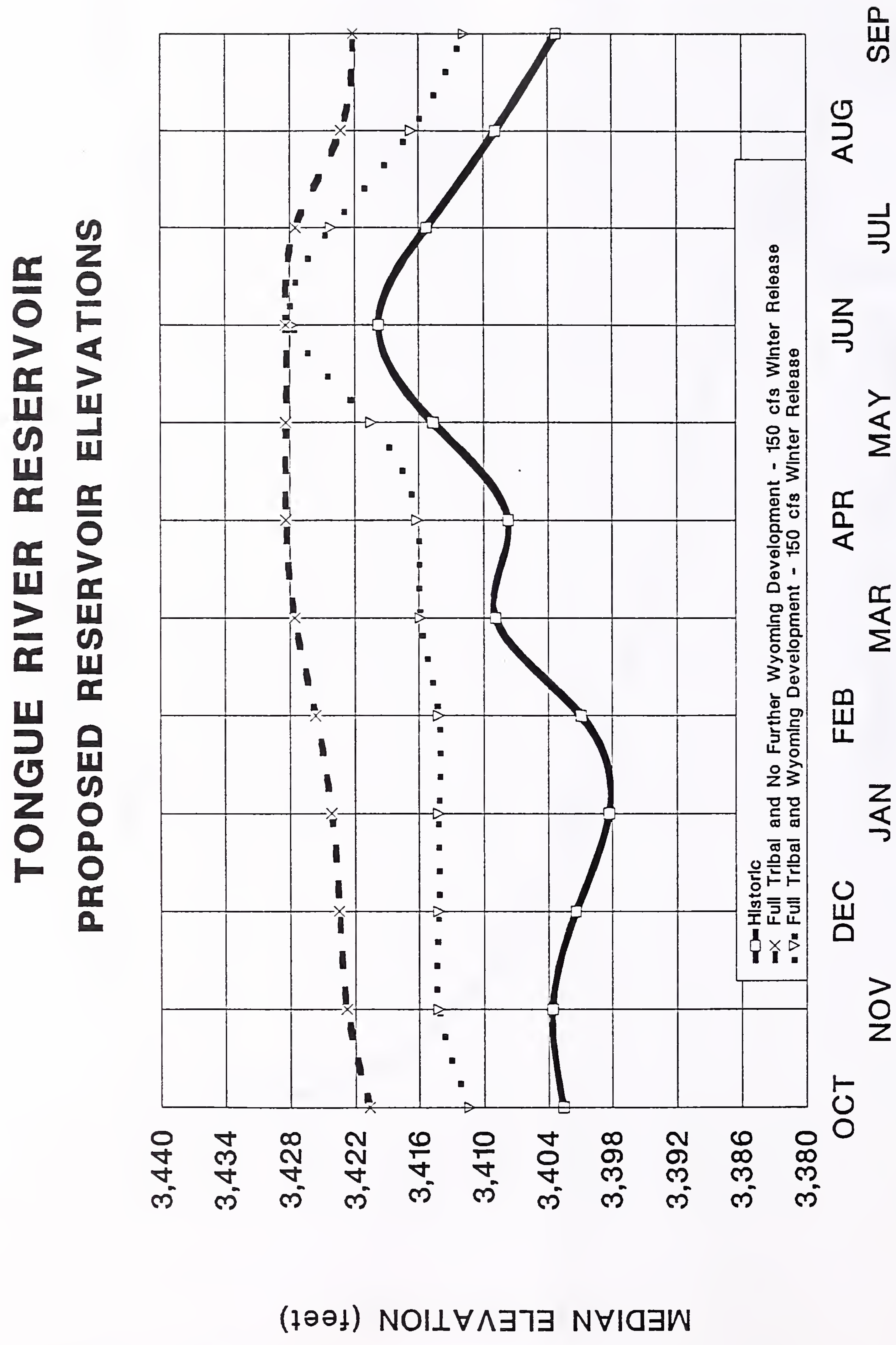


FIGURE 4–4

PROPOSED RESERVOIR ELEVATIONS

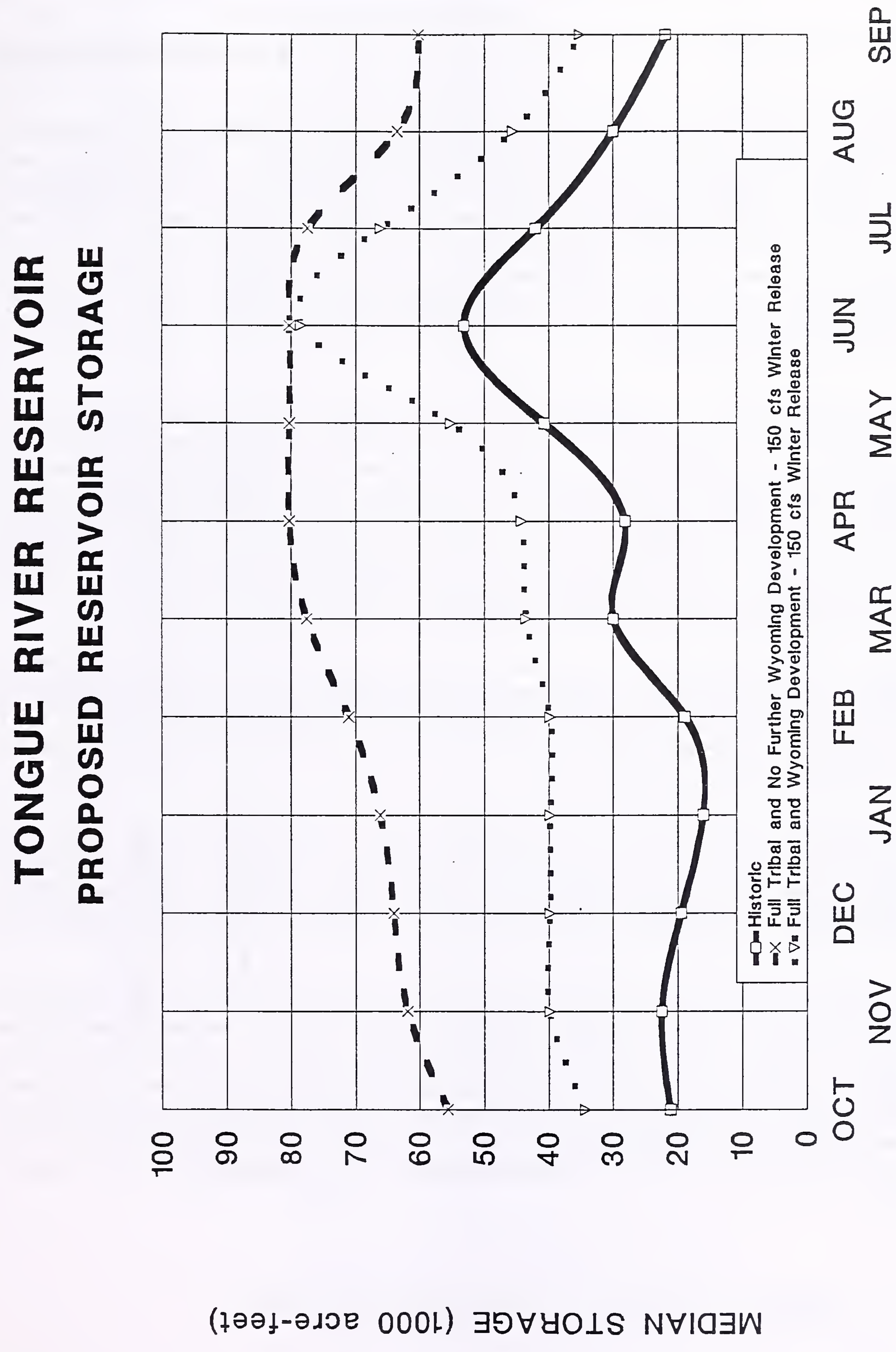


FIGURE 4–5

PROPOSED RESERVOIR STORAGE

In general, operational constraints during construction would result in downstream releases shown on **Figure 4-6 and Table E-7 in Appendix E.** Downstream flows would approximate historic conditions with the exception of temporary reductions related to construction activities, or due to natural-occurring low-inflow periods where releases cannot be made from reservoir storage due to reduced maximum storage levels. Peak downstream releases during the months of heavy runoff would be greater because inflow peaks could not be stored. Typical river stages downstream during construction are shown on **Figure 4-7 and Table E-7 in Appendix E.** Short-term impacts to downstream releases during construction would be minor to moderate. See Chapter 2, Agricultural Mitigation, for the project sponsors' proposed means of assuring that water reaches the T&Y diversion during construction.

Following Construction. The increase in reservoir storage combined with a fully operational spillway would produce changes in downstream releases under both action alternatives. Typical streamflows below the dam following construction are shown on **Figure 4-8 and tables E-8 and E-9 in Appendix E.** Two scenarios are presented for Wyoming's use of Yellowstone River Compact water. See Fulfillment of Settlement Act Water Rights in the Tongue River Basin for further discussions of the Yellowstone River Compact and the Northern Cheyenne - Montana Water Rights Compact. The first scenario is based on no further development of Wyoming's compact water. The second scenario demonstrates full development of Wyoming's Compact water. Typical river stages are shown on **Figure 4-9 and tables E-8 and E-9 in Appendix E.**

Historical streamflows at Miles City are shown on **Figure 3-2 and Table E-10 in Appendix E.** Typical streamflows at Miles City following construction are shown on **Figure 4-10 and tables E-11 and E-12 in Appendix E.** Two scenarios are presented for Wyoming's use of their Yellowstone River Compact water. Typical river depths at Miles City are shown on **Figure 4-11 and tables E-11 and E-12 in Appendix E** for the two Wyoming Compact water scenarios.

These figures and tables demonstrate that streamflow would be reduced from historic levels during heavy runoff months from mid-March through June due to additional reservoir storage. Rehabilitation of the spillway would allow the reservoir to be filled safely to the spillway crest. Streamflow during late summer and fall could be reduced due to irrigation use and increased water storage prior to the runoff season. Long-term impacts to downstream releases under the action alternatives would be negligible to minor.

Reservoir Ice. Reservoir water levels would increase under both action alternatives. Historically, the reservoir has been drawn down by irrigation releases through the summer, and maintained at a low elevation during the winter months (**see Figure 4-4**) to avoid use of the spillway in the spring. The interim operation plan would provide for higher reservoir elevations during the winter months to reduce the rise and fall of reservoir ice which has caused problems for ice fisherman. The increased reservoir elevations during the winter could cause some increased scouring of the shoreline by ice action. Impacts of reservoir operations and increased water levels on reservoir ice formation and damage would be negligible to minor in the short and long terms.

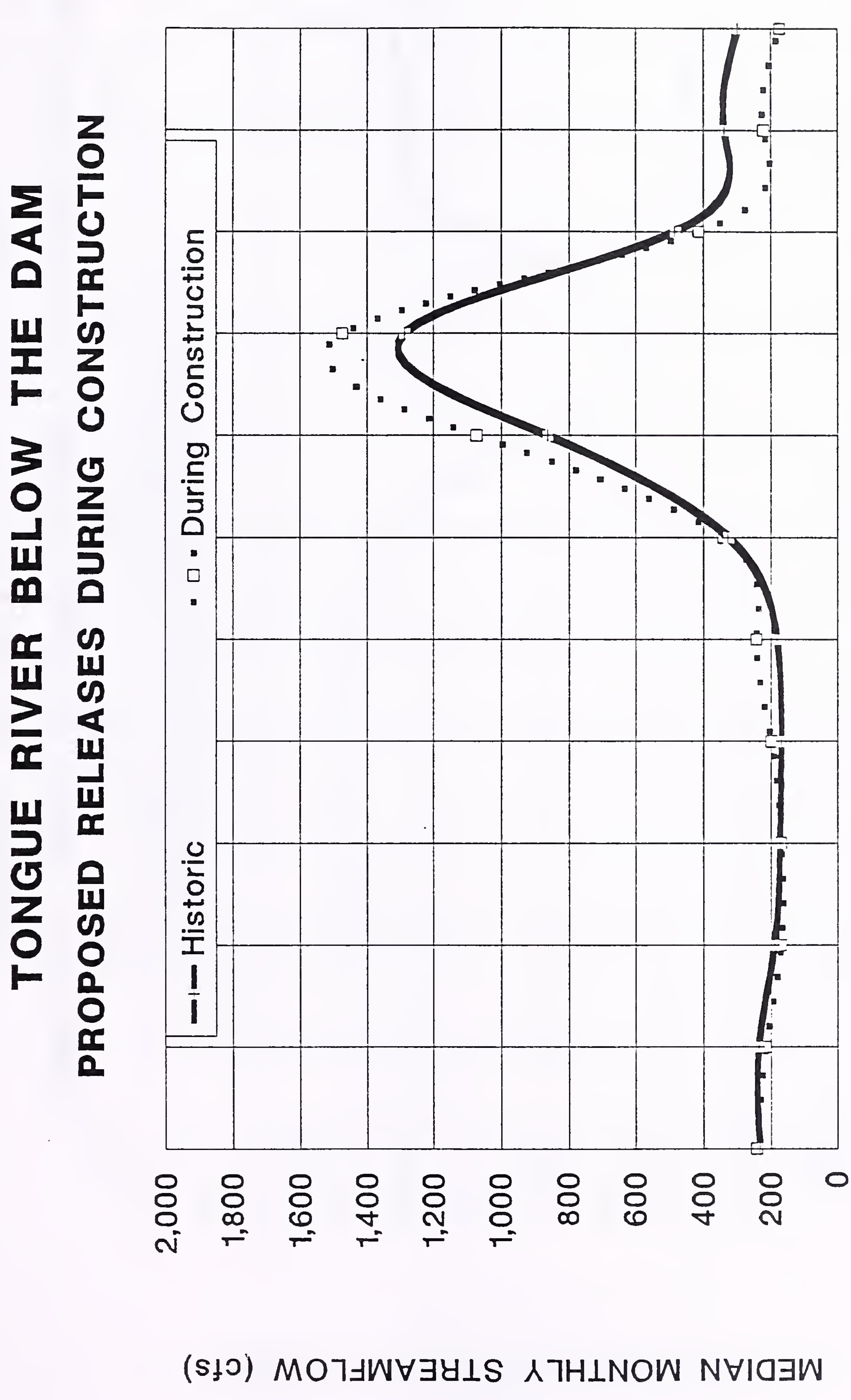


FIGURE 4–6

PROPOSED RELEASES DURING CONSTRUCTION

TONGUE RIVER BELOW THE DAM
PROPOSED DEPTHS DURING CONSTRUCTION

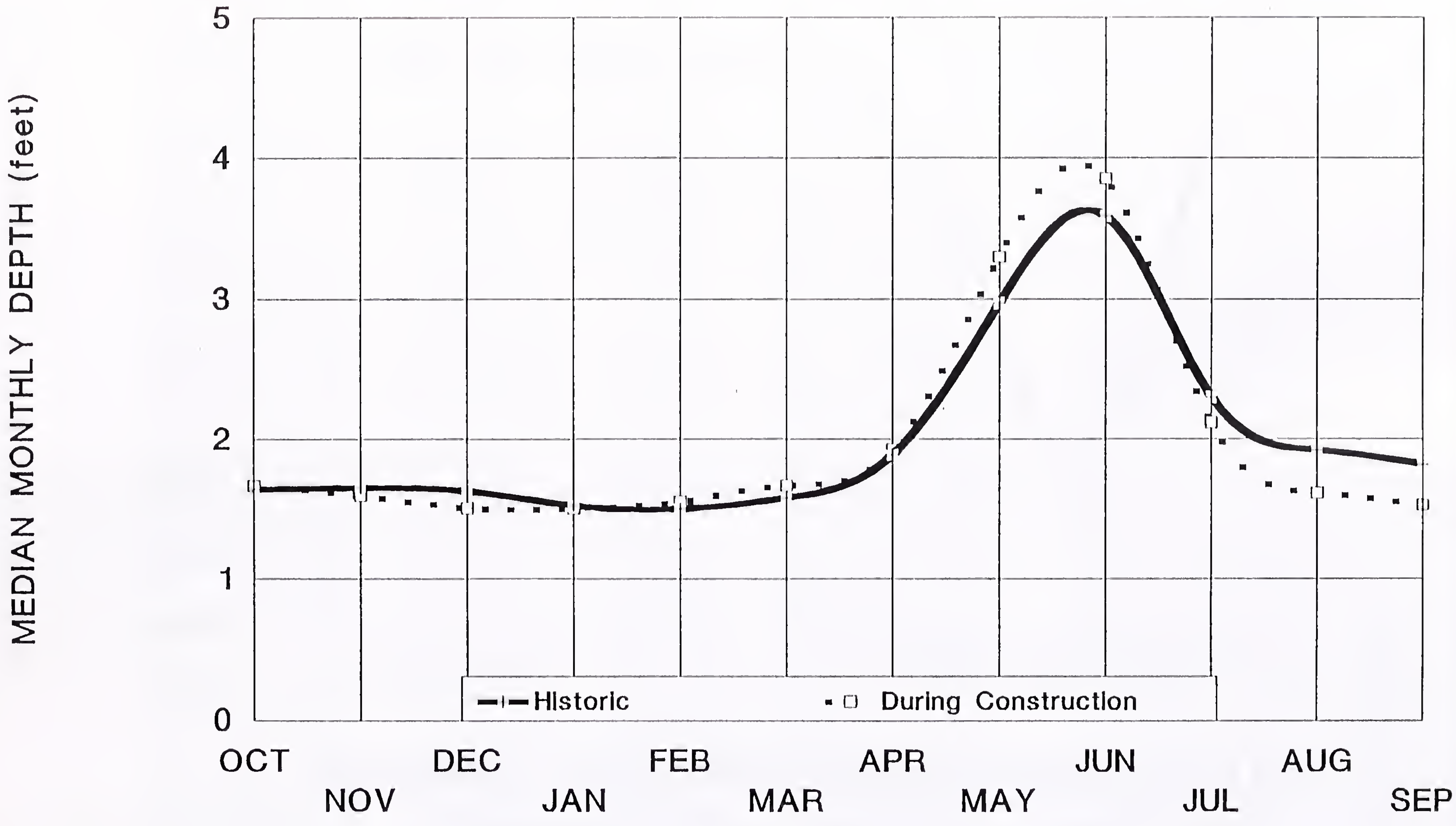


FIGURE 4–7

PROPOSED RIVER DEPTHS DURING CONSTRUCTION

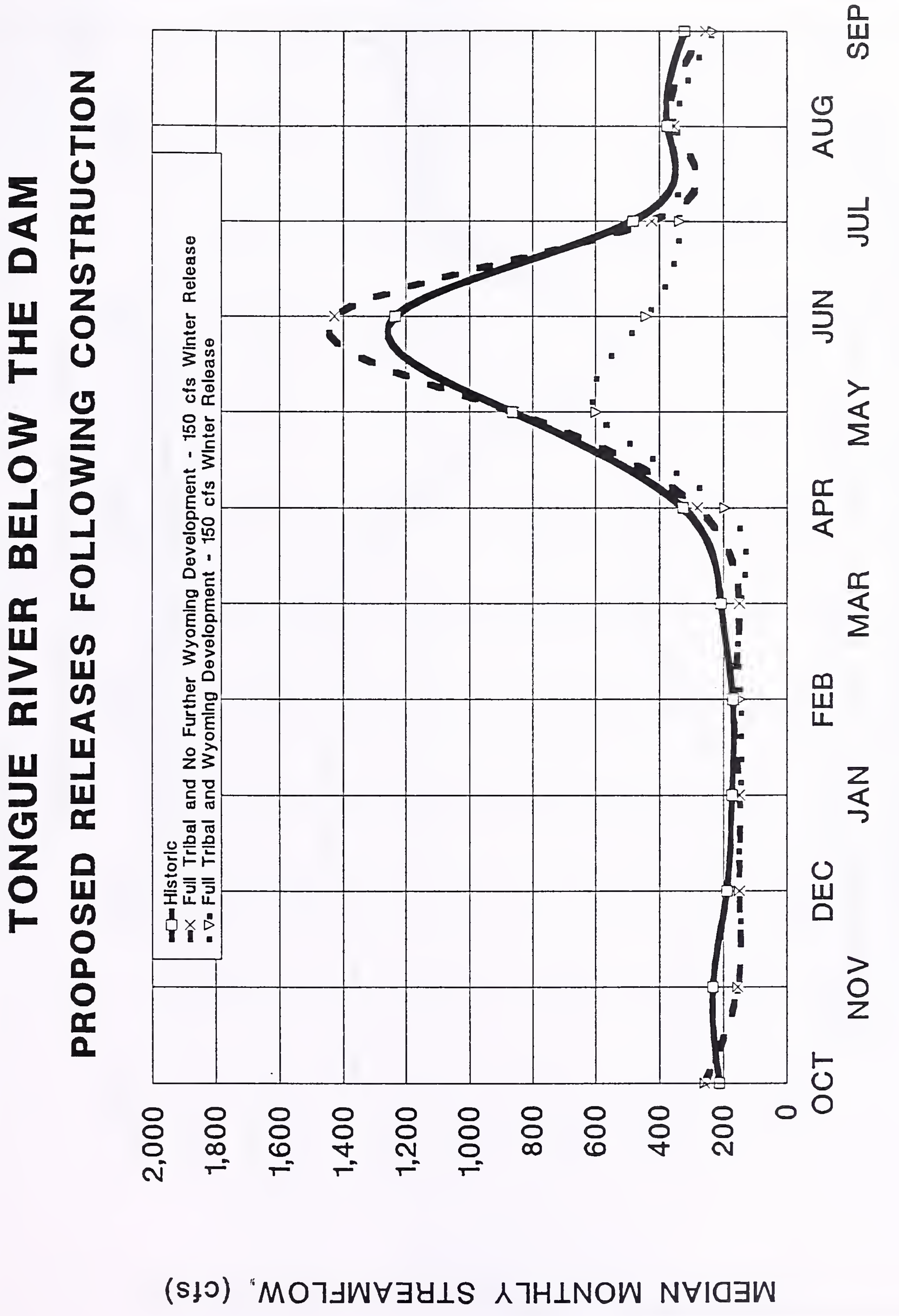


FIGURE 4–8

PROPOSED RELEASES FOLLOWING CONSTRUCTION

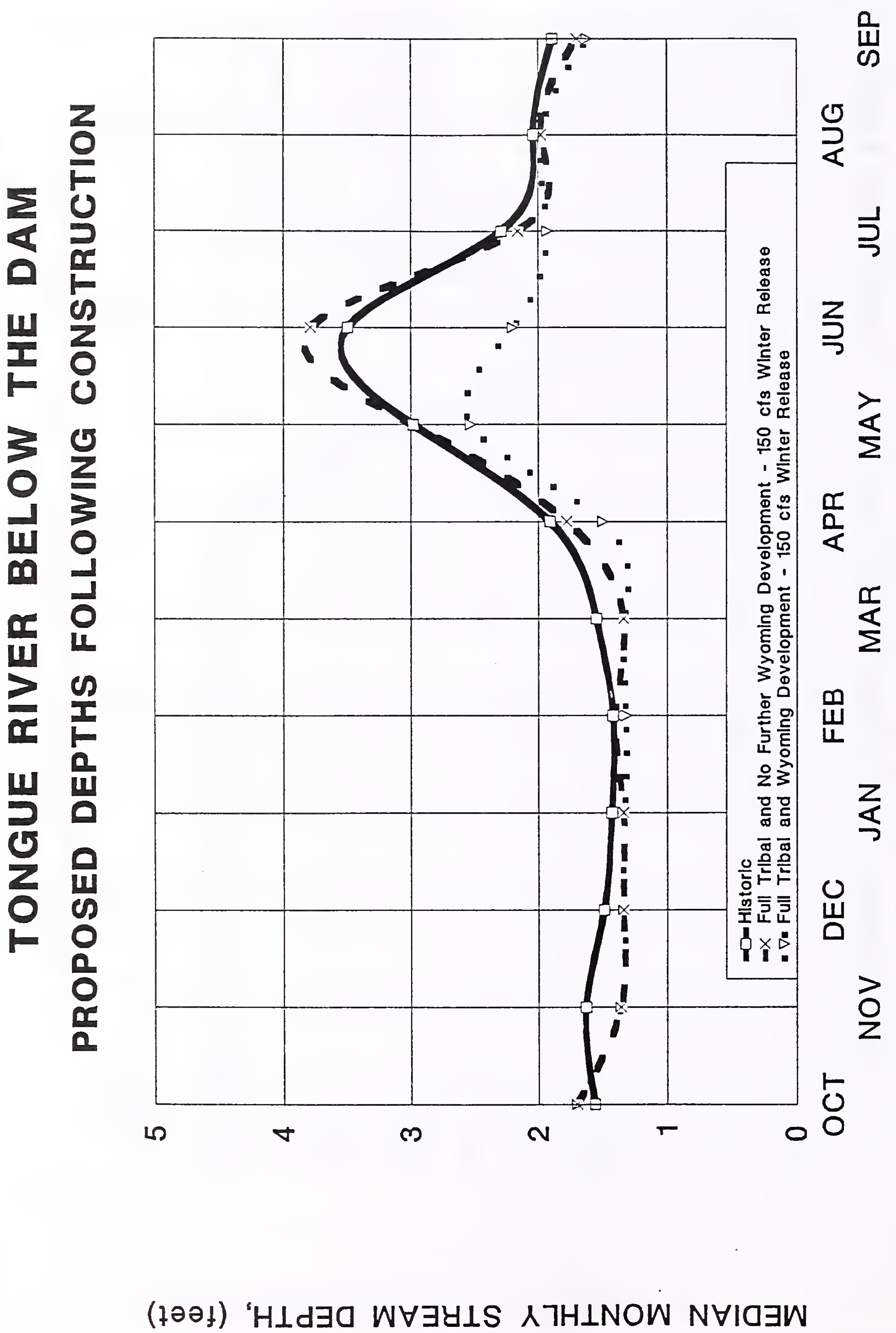


FIGURE 4–9

PROPOSED RIVER DEPTHS FOLLOWING CONSTRUCTION

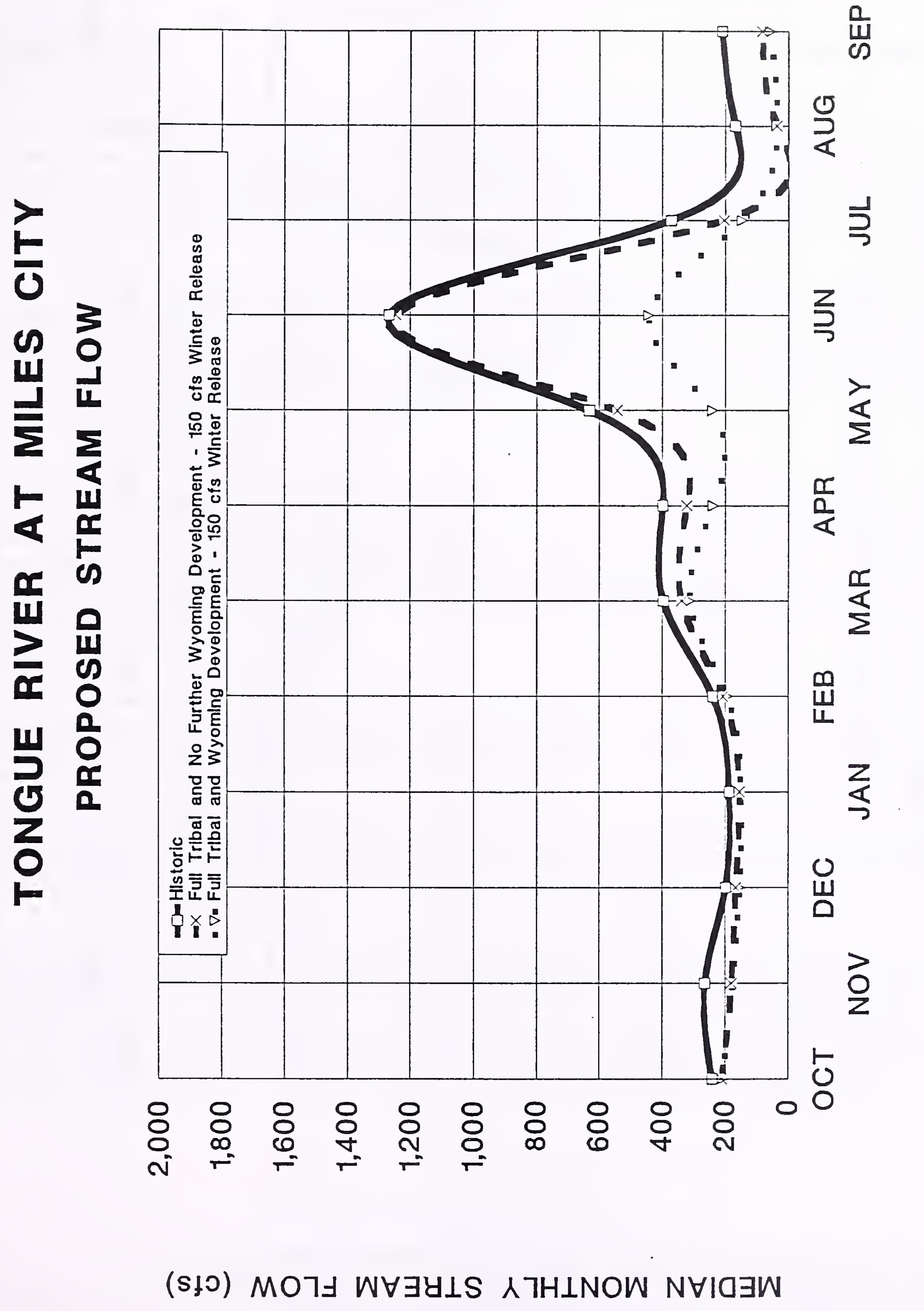


FIGURE 4—10

FLOWS AT MILES CITY
FOLLOWING CONSTRUCTION

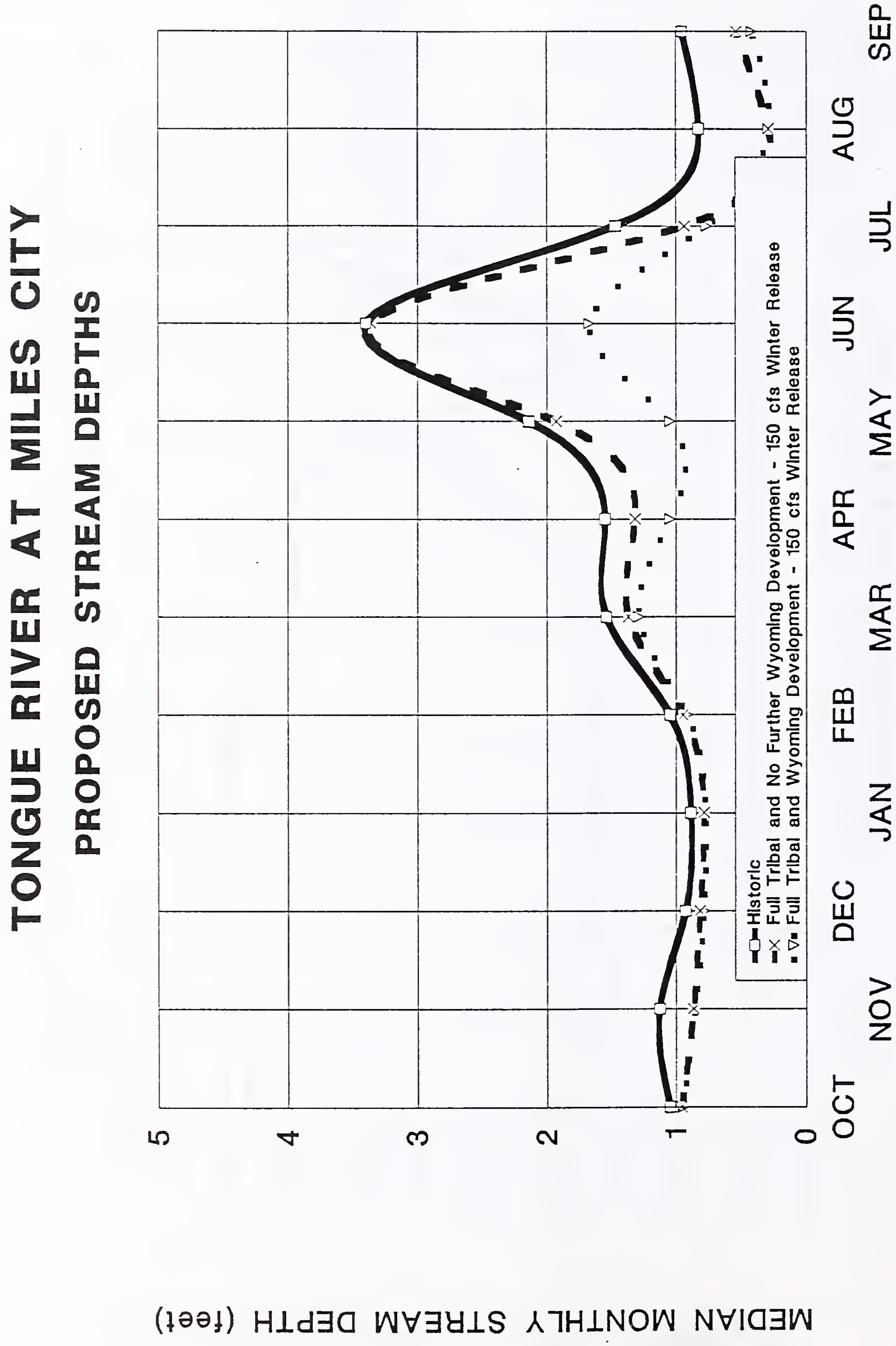


FIGURE 4–11

RIVER DEPTHS AT MILES CITY FOLLOWING CONSTRUCTION

Upstream River Ice. The increased reservoir water levels during winter periods when ice flows are forming in the river above the reservoir could increase ice jamming and flooding of the upper reservoir area. This condition could increase bank erosion and damage woody riparian vegetation from ice scour and flooding of the overbanks. Impacts of reservoir operations and increased reservoir water levels on upstream ice jams and related damage and flooding would be minor to moderate in the short term and minor in the long term.

Downstream River Ice. The interim reservoir operations plan would provide consistent river releases from the rehabilitated project during winter months to provide minimum stream flows and prevent the river from freezing from the bed up (formation of anchor ice). Ice jams and flooding would not be increased above current levels by this operation. Impacts of reservoir operations on downstream ice jams and related flooding would be negligible in the short and long terms.

4.7.1.3 Coal Mines

Proposed construction activities require that the reservoir be drawn down over a 2-year period. Decreasing the reservoir water surface elevations during construction would decrease the elevation differences between the reservoir water surface and pit floors and, other determinants remaining the same, decrease seepage inflows into the coal mine pits. These positive impacts to ground water seepage inflows to the coal mine pits from the decrease in reservoir water levels during construction would be minor to moderate during the construction period.

Under current conditions, ground water seeps from the reservoir into the open mine pits[1]. Seepage rates are determined by the relative elevations between the reservoir water surface and pit floors, distance from the reservoir to the pits, and geologic stratigraphy along the flow paths between the reservoir and pits.

As a result of increased reservoir levels, there would be an increase in the ground water seepage rate into mine pits. Increases to seepage rates are estimated at 200 gallons per minute (gpm) for pits at the south end of the East Decker Mine, up to 540 gpm for the West Decker Mine pits, and between 940 gpm and 3,000 gpm for future pits at the north extension (Western Water Consultants, Inc. 1994).

Impacted facilities at the East Decker Mine could include two existing soil and overburden stockpiles, four monitoring wells, and 11 sections of embankments, one MPDES water quality monitoring station, and one sediment pond. Impacted facilities at the West Decker Mine could include two monitoring wells, and two MPDES water quality monitoring stations. Impacts at the north extension could include four monitoring wells and one MPDES water quality monitoring station. It does not appear that other facilities such as roadway and railroad tracks, culverts and bridges, powerlines, and utilities would be significantly impacted.

---

[1] Past seepage rates into the pits were estimated by MPDES discharge rates, adjustments to these rates, and rates calculated from the USGS Method. The Decker Coal Mine Mitigation Study (Western Water Consultants, Inc. 1994) presents the method of estimating current rates, of calculating future rates, and discusses technical factors influencing these rates. It is the intention of this EIS to disclose the basis for mine mitigation (pumping), and estimate potential impacts of mitigation activities. Historic seepage into pits includes other sources not related to the reservoir. Therefore, impact assessment will focus on estimates of seepage into mine pits as a result of higher reservoir stages over and above existing seepage.

The Decker Coal Company Mine Mitigation Study (Western Water Consultants, Inc. 1994) presents the structural, non-structural, operational and maintenance activities that could be employed to mitigate the impacts to the coal mine pits resulting from the increase in reservoir water levels during postconstruction reservoir operation (see Chapter 2, Coal Mine Facilities Mitigation). Long-term impacts of ground water seepage inflows to the coal mine pits from the increase in postconstruction reservoir water levels would be negligible. Long-term impacts to other local mine facilities from increased reservoir elevations would be negligible.

4.7.1.4 Increased Annual Discharges Associated With Coal Mine Facilities Mitigation

As a result of raising the spillway crest elevation 4 feet and proposed operating procedures, future reservoir levels typically would be higher than historic levels (**see Figure 4-4**). Therefore, ground water seepage rates into mine pits are expected to increase. This increased seepage would require increased pumping rates to dewater the pits, would increase flows to settling ponds, and increase discharge of pit water at permitted discharge stations. Increased discharge flows have the potential to impact the water quality of Tongue River Reservoir and Tongue River downstream of the reservoir.

The collective increase in discharges from the east, west, and north Decker pits could be as high as 3,740 gpm. The concentration of total dissolved solids (TDS) in the discharge could average 1,825 milligrams per liter (mg/l). The average concentration of TDS in Tongue River Reservoir is 440 mg/l. A conservative estimate of the impact of increased mine pit discharges on the quality of flow into the reservoir can be made by blending the maximum discharges from the mine pits with the average flow at the Tongue River Reservoir of 450 cubic feet per second (cfs) (over 200,000 gpm). TDS concentrations weighted by the discharges from the respective pits are combined with flow and TDS concentration at the reservoir. The blending would result in a flow increase of approximately 1 percent (from 450 to 456 cfs) and an increase in TDS concentration of approximately 4.5 percent (from 440 to 460 mg/l). The resulting estimate of the increase in the TDS concentration in the reservoir, assuming typical streamflows and reservoir mixing, likely would not be detectable. Since downstream discharges occur after the mixing of the increased TDS flows within the reservoir, increases in TDS concentrations resulting from pit dewatering may not be detectable. Impacts of increased mine pit discharges on reservoir and downstream water quality would be negligible in the short and long terms.

4.7.1.5 Shallow Ground Water

Proposed construction activities require that overall reservoir operation be altered from existing conditions in terms of storage and releases. The change in the schedule and magnitude of releases has the potential to impact downstream flows and related ground water recharge to shallow aquifers. During construction, a target release of 190 cfs is planned with a one-time short-term (up to 2 weeks) release of not less than 25 cfs.

There are reaches of Tongue River downstream from the dam that either gain from and/or lose water to the adjacent alluvium. There are many hydrologic, climatic, and management factors that determine whether and how much the river gains or loses within a reach. However, ground water recharge immediately below the dam would be impacted more than reaches further downstream; contributions from side streams would recharge shallow ground water further downstream. Construction scheduling and mitigation would be

implemented in such a way as to minimize the impact of streamflow reductions on shallow ground water and its users during the 2-year construction/reclamation period. Short-term impacts on shallow ground water from decreases in streamflows during construction would be negligible to minor.

4.7.1.6 Ground Water

When proposed construction was complete, and during typical years, the reservoir would be operated at higher-than-historic water levels **(see Figure 4-4).** At the proposed spillway elevation, the reservoir surface area would increase by approximately 400 acres. As unsaturated surface soils and subsurface materials were inundated, water would infiltrate and percolate through the materials. The main factors that determine how quickly or slowly water moves into and through soil materials are the depth of overlying water and the characteristics of the materials. The length of time that water covers soil materials is also an important determinant of the amount of water that infiltrates and percolates through the soil. In any case, the rates at which water moves into and through soil materials and to ground water eventually stabilizes, or reaches equilibrium. Equilibrium rates usually are much slower than initial rates because the soil materials are saturated at equilibrium. Equilibrium rates are limited by the least porous layers of materials through which the water must move, with clays being almost impervious.

As soil materials become saturated and equilibrium rates of water movement through the materials are reached, water movement is either retarded by an impervious layer or moves into ground water. In the area where water moves through the newly saturated materials into the ground water, a mound is formed which effectively raises the elevation of the ground water surface. The mound dissipates and the higher ground water surface quickly returns to its normal elevation at a short distance from the newly saturated area. Depending on surface and subsurface soil material, characteristic ground water surface elevations would be expected to increase in the immediate vicinity of the shoreline resulting from higher reservoir water levels. Long-term impacts to ground water from increased reservoir water levels would be negligible.

4.7.1.7 Ground Water Quality

At the proposed new crest elevation, increased reservoir surface area would provide the potential for water to saturate surface soils and percolate to the ground water. As water percolated through unsaturated soils and contacted soluble materials, there would be the potential for increased concentrations of TDS in ground water.

The volume of soluble materials available to be dissolved and carried into ground water by percolating surface water is extremely variable and depends heavily on TDS concentrations in the percolating water and chemical and physical characteristics of the soil materials. In any case, once the soluble materials were dissolved (leached) out of the affected soil material, the concentration of TDS in the percolating water would return to near-existing levels. Impacts to ground water quality from increased reservoir levels would be minor in the short term and negligible in the long term.

4.7.1.8 Surface Water Quality

Construction activities have the potential to increase the turbidity (or suspended sediment) in the reservoir and downstream in the Tongue River. Dam rehabilitation and construction of the spillway stilling

basin, coffer dams, and destruction of the coffer dams have the potential to increase turbidity of water in the reservoir and river. Scheduled construction drawdowns or low-flow periods, causing short-duration increases in turbidity, could be expected throughout the construction period. Short-term impacts to reservoir and downstream water quality from increased turbidity during construction would be minor to moderate.

4.7.1.9 Flood Events

Construction of the Tongue River Dam substantially changed the peak flood flows in the valley downstream of the dam (see **Figure 2-4 and Table 4-4**). For comparing pre-dam and existing conditions it is assumed the pre-dam condition is equal to the reservoir inflow. In general, the existing spillway reduced flood peaks in the downstream valley by 60 percent.

Projected flood flows (in the first 10 miles of the river below the dam) under each action alternative are summarized in **tables 4-4, 4-5, 4-6, and 4-7**. The characteristics of various flood flows associated with these proposed alternatives, pre-dam conditions, and existing conditions are described in terms of peak discharge (cfs), topwidth (width of flooding) of flood flow (ft), area of the floodplain (acres per mile), and depth of flood flow (ft). Additional discussions regarding spillway design flood selection, dominant discharge, and flood events may be found in **Appendix E**. Pre-dam conditions are shown to illustrate flows in case of a dam failure.

4.7.1.10 Reservoir Evaporation

Both action alternatives would result in an increase in annual evaporation from the reservoir: from 5,090 to 6,650 acre-feet. This 30 percent increase in annual evaporation (1,560 acre-feet) represents only 0.5 percent of the average annual inflow (332,000 acre-feet) to the reservoir. The hydrologic impacts of increased reservoir evaporation would be negligible in the short and long terms.

TABLE 4-4
Comparison of Flood Peaks (cfs)

FLOOD	PRE-DAM (INFLOW)	EXISTING SPILLWAY	LABYRINTH SPILLWAY	RCC SPILLWAY
5-Year	9,993	4,575	7,042	4,727
10-Year	13,108	5,608	9,143	6,437
25-Year	17,646	6,711	13,171	9,790
50-Year	21,377	8,344	15,792	10,444
100-Year	25,410	10,249	18,928	11,135
500-Year	35,897	15,889	22,743	15,694

Source: Department of Natural Resources and Conservation 1994.

TABLE 4-5
Average 100-Year Topwidth for Four Scenarios

	TOPWIDTH, ft	CHANGE, ft	% CHANGE
Pre-Dam	556	195	54
Existing	361	0	0
Labyrinth Weir	467	106	29
RCC	387	27	7

Source: Morrison-Maierle/CSSA 1994.

TABLE 4-6
Average 100-Year Floodplain Area for Four Scenarios

	ACRES/MI	% CHANGE
Pre-Dam	61	30
Existing	47	0
Labyrinth Weir	57	21
RCC	50	6

Source: Morrison-Maierle/CSSA 1994.

TABLE 4-7
Average 100-Year Flood Depth for Four Scenarios

	DEPTH	CHANGE, ft	% CHANGE
Pre-Dam	15.44	5.00	48
Existing	10.44	0.00	0
Labyrinth Weir	13.50	3.06	29
RCC	10.81	0.38	4

Source: Morrison-Maierle/CSSA 1994.

4.7.1.11 Dam Breach Event

For purposes of this analysis, a dam breach is the rupture that would remove the dam embankment, and the associated sudden release of reservoir contents. Two dam breach scenarios were evaluated. The discussion and results of the evaluations are presented in **Appendix E.** The scenarios included a clear-weather breach, associated with an earthquake or problem internal to the dam, and a breach associated with the probable maximum flood on the Tongue River. Both scenarios produce substantial discharges and wave characteristics at downstream locations. (Detailed mapping of dam breach inundation is on file at DNRC.)

The impacts of the breach scenarios are not considered direct impacts of project alternatives but rather as reasons that the dam and spillway are classified as high hazard. The hazard classification and unacceptable risk of failure are reasons that action alternatives 1 and 2 are proposed.

4.7.1.12 Long-term Results of Dam Failure

If the dam failed, the 100-year flood, and floods of more frequent recurrence intervals, would be characterized by the pre-dam discharge, topwidth, floodplain, and flow depth presented in **tables 4-4, 4-5, 4-6, and 4-7** after the breach occurred. These impacts would be major and significant.

This determination of significance is based on the fact that the 100-year flood flow would not be largely contained in the downstream channel as it is under existing conditions. Downstream flood damage would include threats to human life, property, livestock, and agricultural land. Flood damage could also include stream channel meandering, land parcels being cut off and isolated, and damage to vegetation and wildlife. Downstream impacts of the 100-year flood event after dam failure would be moderate to major and significant in the short and long terms.

4.7.2 Effects Unique to Alternative 1

During construction, the reservoir would be maintained at the highest possible volume, estimated to be between 9,000 and 30,000 acre-feet for the labyrinth weir alternative. This level would be governed by safe operating limits for the proposed construction activities.

Peak flood discharges for the labyrinth weir alternative are presented in **Table 4-4** for six design floods. Peak discharges for the six design floods increase by an average of 43 percent over existing conditions under the labyrinth weir alternative. The labyrinth weir design increases the spillway's capacity to pass water without increasing spillway width. During flood events of 25-year recurrence interval and above, flows exceed the capacity of the downstream channel (see **Appendix E**). The average topwidth of the 100-year flood event would be 467 feet for Alternative 1. When compared to the existing condition of 361 feet, this is an increase of 23 percent.

Alternative 1 increases the 100-year floodplain area by 10 acres per mile for a 16 percent increase over existing conditions. This alternative also increases the flood depth for the 100-year event by 3.06 feet, or a 23 percent change from existing conditions.

The change from Alternative 1 in the characteristics of the 100-year flood as measured by increased peak discharge, increased topwidth, increased floodplain, and increased flow depth are considered to be significant. This determination of significance is based on the fact that the 100-year flood flow would not be mostly contained in the downstream channel as it is under existing conditions. Downstream flood damage would include threats to human life, property, livestock, and agricultural land. Flood damage could also include stream channel meandering, land parcels being cut off and isolated, and damage to vegetation and wildlife. Downstream impacts of the 100-year flood event would be moderate to major and significant in the short and long terms.

4.7.3 Effects Unique to Alternative 2

During construction, the reservoir would be maintained at the highest possible volume, estimated to be between 9,000 and 45,000 acre feet for the RCC spillway alternative. These levels would be governed by safe operating limits for the proposed construction activities.

The characteristics of the 100-year flood and lesser events under the RCC alternative are presented in **tables 4-4, 4-5, 4-6 and 4-7**. Comparing peak discharge, topwidth, floodplain area and flow depth for the 100-year flood under the RCC alternative to existing conditions results in minor differences. The RCC maintains the approximate capacity of the existing dam to pass water at a given spillway width.

While the 100-year flood event characteristics increase under the RCC alternative when compared to existing conditions, the changes are minor (up to 7 percent). The downstream impacts of the 100-year flood event under the RCC alternative would be negligible in the short and long terms.

4.7.4 Effects From Alternative 3

Under the no-action alternative, reservoir operations and downstream releases would remain at current levels. Ice jam occurrences and coal mine pits seepage inflows would remain the same and the discharge and recharge characteristics of ground water would remain unchanged. Ground and surface water quality would remain at existing levels. Impacts of the no-action alternative on reservoir operations, releases, ice jamming, coal mine pit seepage, surface water quality, and ground water quality and quantity, would be negligible. The existing dam and spillway would continue to route flood events as described in **tables 4-4, 4-5, 4-6, and 4-7**. The downstream impacts of the 100-year flood event (without considering dam failure) under Alternative 3 would be negligible in the short and long terms.

The existing dam and spillway are classified as high hazard. The potential for loss of life drives the hazard classification. Without repair, the existing dam has an unacceptable risk of failure. For a description of a breach or dam failure, see previous discussion under Dam Breach Event and Long-Term Results of Dam Failure. After a breach event, the downstream impacts of the 100-year flood would take on pre-dam characteristics that would be significant.

4.7.5 Cumulative Effects

Construction of the Tongue River Railroad would include five bridges between the Tongue River Dam and Four Mile Creek. While a final construction schedule for the railroad and the five bridges has not been

prepared, if bridge construction was simultaneous with proposed project construction, effects on downstream turbidity could be cumulative. The cumulative effects could be moderate to major in the short term and negligible in the long term.

4.8 WETLANDS

A major part of the proposed action, raising the dam and replacing the spillway, would result in flooding and loss of 541 acres of riparian-wetland habitat (Miles and Hansen 1992). The project sponsors have estimated that 5 to 25 percent of this loss (27 to 135 acres) could be classified as jurisdictional wetlands (see Chapter 3, Wetlands). Wetlands losses would be mitigated under Section 404 of the Clean Water Act and under the Fish and Wildlife Coordination Act. Recommendations in the Fish and Wildlife Coordination Act Report (U.S. Department of Interior, Fish and Wildlife Service 1992) identify the need to mitigate wetlands and riparian areas because of important ecological values of both wetlands and riparian areas. Specific mitigation has been devised (see Chapter 2, Monitoring and Mitigation) to compensate for lost or degraded wetland and riparian functions and values that would result from the proposed action. Therefore, impacts to wetlands are assumed to be negligible in both the short and long terms. For further discussion of impacts on wetlands, see Implementation of Fish and Wildlife Habitat Enhancement Features.

4.9 AQUATICS/FISHERIES

4.9.1 Effects Common to the Action Alternatives

4.9.1.1 Drawdown Effects Within the Reservoir

After installation of the coffer dam across the entrance to the existing spillway in the spring of 1997, and during the first construction season, reservoir contents would be maintained at the highest possible volume governed by safety. Maximum reservoir storage would be 30,000 acre-feet for labyrinth weir or 45,000 acre-feet for RCC. These maximum reservoir pool capacities are comparable to the current reduced maximum and median storage capacity of about 40,000 acre-feet and 29,000 acre-feet, respectively. Therefore, negligible to minor impact to the reservoir fisheries would be expected from this activity when compared to present operations.

During the fall of 1997, reservoir storage capacity would be reduced to about 9,000 acre-feet (elevation 3,390.5 feet) by mid-October in order to repair the existing low level outlet works. This 9,000 acre-foot reservoir pool was identified during discussions among the project sponsors, DFWP and USFWS, as the minimum acceptable impoundment during this phase of construction. When the pool elevation reached within about a foot of the screen grates at the top of the intake, a circular coffer dam (sheet piling and earthen material) would be placed around the structure prohibiting flow into the outlet works. Median pool capacities are about 23,000 acre-feet for the month of October, or about 14 feet higher than the intake grate structure. Rehabilitation of the outlet works is proposed to begin with a gradual reservoir drawdown at the conclusion of the irrigation season in late September under both action alternatives. Pool capacities would not be expected to increase after installation of the coffer dam until spring runoff in 1998, due to planned releases of run-of-river flows through the winter months.

Reservoir capacities would be expected to be about 9,000 acre-feet from mid-October to April of the following year. Volumes of 9,000 acre-feet result in a reservoir surface of about 700 acres, with average and maximum depths of 12.7 feet and 26.1 feet, respectively, or about half of the reservoir's normal over-winter size. Since DFWP contends that reservoir capacities need be maintained at no less than 25,000 acre-feet for the benefit of fisheries, there would be impacts associated with this activity. However, the 9,000 acre-feet capacity should easily over-winter a significant fraction of adult fish and moderate temperature fluctuations, increasing the potential for successful spawning and egg incubation (Phillip Stewart, Department of Fish, Wildlife and Parks, in a letter to Edward Pettit, February 15, 1995). The schedule for rehabilitation of the outlet works would be expected to alleviate the potential of large fish kills in the reservoir attributable to low dissolved oxygen in the winter months or lethal temperatures during the summer. The magnitude, importance, and ultimate duration of impact depend on actual climatological conditions encountered and length of time pool volumes remained low.

If low reservoir capacities extended into the summer of the second construction season, reduced areas of shallow littoral zone (along the edge) habitat could result. These areas are used by fish for spawning and rearing of juveniles of many species. Lower pool capacities could tend to favor warm-water fish over cool-water species since reservoir temperatures would more closely parallel those of the river inflow, typically higher than that of the reservoir during summer months. The loss of reproductive and protective habitat and increased water temperature could result in lower success or higher mortality for this year class of the reservoir fisheries. This loss could be compounded in that low volumes in the pool also would concentrate the fish, leading to higher losses to both smaller fish species and juvenile game/sport fishes due to increased opportunity for predation. Increased numbers of fish also could be expected to be swept through the outlet works because of higher fish concentrations in proximity to the intake structure. Fish mitigations discussed in Chapter 2, Proposed Mitigation and Monitoring, would compensate for construction-related losses.

Direct impacts of drawdown and reduced pool capacities on reservoir fisheries would be minor to moderate in the short term and negligible to minor in the long term. If, however, construction-related activities were combined with a low-probability naturally occurring event, such as low precipitation and high temperatures in successive years, the combined effect would have the potential to be moderate to major and significant and require plantings of game/sport fish species to achieve appropriate mitigation.

4.9.1.2 Reduction in Flows Downstream of the Dam

Planned downstream releases of water during construction would be sufficient to satisfy the T&Y diversion water right of about 190 cfs for both action alternatives. The exception to this flow regime would take place after the 1997 irrigation season during the rehabilitation of the low level outlet works and could extend to spring runoff 1998. Planned flows for this timeframe would be about equal to the inflow to the reservoir except for up to 2 weeks in late October. Monitoring of aquatic life would be performed by DFWP (see Chapter 2, Proposed Mitigation and Monitoring). If adverse effects to the fisheries were observed, pumping would be increased up to 75 cfs in order to alleviate impacts. Water temperatures would generally be run-of-river and within the natural ranges for biota.

Pumping would be required for a time to release water to the river downstream of the dam because water would be prevented from entering the intake during repairs of the outlet works. It would take up to 2 weeks for reduced reservoir levels to fill to the intake of a proposed auxiliary outlet works or for a temporary

bypass to be installed in the existing low level outlet works if used for the RCC alternative. During this timeframe, at least 25 cfs flows would be delivered to the river by pumping from the reservoir.

Historical run-of-river flows during these months (October through April) approximate instream flow requirements for aquatic species of concern about one-half of the time. Historically, releases of stored water during these months have allowed these flows to be achieved with greater frequency: about 80 to 90 percent of the time. However, certain life-cycle requirements for some species, including passage, spawning or rearing flows, could be disrupted. Mitigations have been proposed to offset potential impact to the fishery.

Since 1975, very low-flow conditions have been recorded on four occasions immediately downstream of the dam. During 27 days from October 31, 1975 through November 26, 1975, and for 5 days from June 20, 1977 through June 24, 1977, flows of 15 to 25 cfs, and 3 to 4 cfs occurred, respectively. A 44-day period from February 15, 1987 through March 30, 1987 had flows of 55 to 66 cfs. An 8-day period from April 2, 1987 through April 9, 1987 had flows of 12 to 17 cfs. Fish mortality was reported by various observers during these events, although no formal quantitative investigations were performed. The effects on smaller fish were not documented, but heavy predation was suspected. Negative effects on the fisheries, however, were judged to be minor and difficult to measure (Phillip Stewart, Department of Fish, Wildlife and Parks, letter to Greg Ames, November 10,1994). Negative effects on aquatic life that was unable to migrate from exposed substrate were moderate to major but believed to be short term due to their relatively short life cycles. These aquatic lifeforms have the ability to quickly recolonize once habitable conditions are re-established.

Although historic low-flow periods have had minor long-term impacts on the river fisheries, additive effects from planned construction activities could increase the magnitude of impact. Increased turbidity and sedimentation resulting from constructing a bridge, coffer dams, and excavation activities, if preceded by an extended period of above-average temperature water releases, would likely have stressed the aquatic community prior to the planned low-flow release period. The proposed one-time low flow (2 weeks of not less than 25 cfs) would have greater potential for high-magnitude, short-term impacts on periphyton and macroinvertebrates than any other single aspect of the project.

Effects of sedimentation on aquatic life are well documented and include: clogging and abrading of respiratory surfaces, entombing of eggs and other life stages, avoidance of affected habitat, reduction of primary production, and reduction in catchability of fish (an indirect effect). The fisheries mitigation proposed would compensate for anticipated losses downstream of Four Mile Creek. However, the river fisheries likely could not avoid all the effects of sedimentation and lower flow. Lack of deeper pools in the river reach below the dam, combined with increased sedimentation and the planned one-time low flow (25 cfs) could negatively affect some life-cycle aspects of all the fisheries in this area. Even run-of-river flows (proposed for late fall and winter) have been determined insufficient by DFWP in about 5 of every 10 years to totally protect aquatic species (Phillip Stewart, Department of Fish, Wildlife and Parks, memo to Edward Pettit, DNRC, January 1995). Exposed substrate and sedimentation could also negatively impact periphyton and macroinvertebrate populations, many of which would be unable to move or drift out of the affected area, and would slow down recolonization rates. However, planned reservoir releases for the winter months are expected to be sufficient to prevent anchor-ice formation and its associated devastating effects to aquatic life.

Impacts to aquatic life would be minor and short term for the lower reach of river and minor to moderate in both the short and long terms in the reach immediately below the dam. If conditions developed that inhibited or precluded reproductive success or caused a high percentage of fish mortality, impacts would be major and significant in the short and long terms.

4.9.1.3 Postconstruction Operations

Two of the goals of the reservoir operations plan are to provide for more stable pool elevations as well as less fluctuation in downstream releases from the dam. Increased storage volumes and reservoir operations that promoted stability within the reservoir and river downstream would be beneficial to fisheries.

Inundation of areas containing woody riparian vegetation would provide new spawning substrate and more secure short-term (until it decomposed) habitat for smaller or younger fish. About a mile of upstream river habitat would be replaced by reservoir, but the effect on the system in general would be negligible, with habitat characteristics eventually returning to ambient conditions.

Ability to discharge larger volumes of cooler reservoir water into the river during the summer months could benefit cool-water fish species and possibly extend the range for trout below the dam after construction was complete. The river, however, would retain the attributes of a warm-water stream. Impacts of the rehabilitated project on aquatic life, including implementation of the proposed operations plan, would be minor to moderate and beneficial in the long term. For further discussion of impacts on aquatics/fisheries, see Implementation of Fish and Wildlife Habitat Enhancement Features.

4.9.2 Effects Unique to Alternative 1

If an auxiliary outlet works were not used under Alternative 2, then the following impacts could be unique to Alternative 1. The use of an auxiliary outlet works would allow for delivery of water downstream of at least run-of-river and potentially up to 600 cfs depending on availability. It would also be capable of delivering these volumes downstream during placement of the coffer dam around the inlet to the low level outlet works.

The auxiliary outlet would be beneficial to aquatic biota because it would allow at least run-of-river flows during construction and would eliminate the need for future river flow shutdowns to perform routine maintenance activities on the outlet works. Impacts of implementing this aspect of the alternative would be beneficial and minor to moderate in both the short and long terms.

4.9.3 Effects Unique to Alternative 2

If a bypass in the low level outlet works were used (not the auxiliary outlet option) under Alternative 2, run-of-river (up to 200 cfs) releases may not meet previously discussed flow requirements for various life-cycles of many fish species. The use of a bypass would require the installation of a temporary bulkhead in the intake structure. Although use of the bypass would be of short duration (about 2 months), it would not preclude the need for future flow shutdowns to accomplish outlet repairs and routine inspection.

Impacts of implementing a bypass would be similar to existing conditions. Flow shutdowns have historically occurred with unmonitored results. Impacts would be minor to moderate in the short term, depending on duration of shutdown and actual physical conditions encountered, and would be negligible in the long term when compared to present operations.

4.9.4 Effects From Alternative 3

The no-action alternative would extend the status quo of reservoir operation and subsequent river flows for an indefinite period. DNRC has concluded the dam has an unacceptable risk of failing even when operated at a reduced level.

The no-action alternative would have no effect on current aquatic organisms and fisheries resources unless the dam failed. At dam failure, the reservoir fishery habitat would cease to exist and reservoir and downstream channel scouring would cause substantial destruction of aquatic and fisheries habitat.

The no-action alternative's ultimate impact on aquatic organisms and fisheries would be negligible in both the short and long terms unless the dam failed. Impacts if dam failure occurred would be major and significant in the short term but would eventually return to pre-dam conditions.

4.9.5 Cumulative Effects

The proposed Tongue River Railroad (TRR) preferred alternative's planned route would cross the river five times in the first 10 miles downstream of the dam (to Four Mile Creek). This could have substantial negative effects on the aquatic resources in this river reach.

Since the TRR project and the proposed project could be constructed during the same timeframe (1997-1998), cumulative effect on aquatic biota related to sediment or total suspended solids could increase under this scenario. Cumulative effects under possible low-flow conditions would be major and significant in both the short and long terms and the reach of river affected would likely extend further downstream.

4.10 WILDLIFE

4.10.1 Effects Common to the Action Alternatives

4.10.1.1 Terrestrial Wildlife

An increase in reservoir water level would inundate much of the present block of woody and herbaceous riparian habitat at the south end of the reservoir. Loss of this and other habitat types described below would displace white-tailed deer population and some varieties of birds in the short-term. Some species, especially cormorant and great blue heron would continue to use the dead (flooded) trees as long as they remained standing and could relocate upstream to available habitat. Other species (i.e., some warblers, vireos, orioles) that show a strong preference for shrub or deciduous trees would be moderately affected due to the loss of the shoreline band of riparian vegetation.

The current band of woody vegetation around the reservoir is heavily concentrated within an elevational range of some 8 feet, and in a relatively large, flat area at the southern end of the reservoir occupying essentially the same elevation. Because of generally steeper shoreline slopes at the new water elevation, the woody band would be narrower and discontinuous (confined to perhaps 2 to 4 feet of elevation in the short term). In the long term, wave action would create a more gradual slope, allowing some of the woody band to re-establish. The flat, heavily vegetated area at the southern extreme of the reservoir would also be much smaller because of reservoir inundation combined with steeper terrain. A smaller area along the east shoreline of the impoundment appears to offer some limited opportunity for the establishment of woody riparian vegetation. These areas that have the potential for the natural re-establishment of woody and riparian vegetation would eventually offset some of the loss of the wildlife habitat expected from construction of the project.

A portion of the 114 acres of herbaceous riparian wildlife habitat flooded by the project would become re-established naturally. However, the permanent loss of some 73 acres of this habitat type, having important value to many forms of wildlife, is expected. Expected net losses of grassland and scrub/forest wildlife habitats are 139 acres and 25 acres, respectively (Northern Cheyenne Tribe, Department of Natural Resources and Conservation, and U.S. Bureau of Reclamation 1992).

Riparian habitat losses would be mitigated in accordance with the wetland and riparian mitigation plan (see Chapter 2, Proposed Mitigation and Monitoring). Neotropical migrants would likely overfly the reservoir and use riparian areas above and below the reservoir during the period of riparian re-establishment. Thus, the impact of songbirds (many of which are neotropical migrants) would be minor in the short term and negligible in the long term. Impacts on other terrestrial wildlife from the action alternatives would be moderate to major and significant in the short term and minor in the long term. For further discussion of impacts on wildlife, see Implementation of Fish and Wildlife Habitat Enhancement Features.

4.10.1.2 Waterfowl

Drawdown during construction could considerably reduce the use of the area by migrating ducks in the short term. The limited loss of woody and herbaceous riparian, and grassland wildlife habitats would also adversely impact waterfowl. Some loss of Canada goose habitat and limited loss of nesting areas by duck species would occur. Canada goose, cormorant and great blue heron nesting at the south end of the reservoir and nearby would be dislocated; some of this may become re-established further upstream if suitable habitat remains available. Some cavity-nesting species (wood ducks) would continue to use flooded trees as long as they stood. Impacts to waterfowl habitat would be mitigated in the long term by proposed habitat mitigation and enhancement plans. Impacts on waterfowl from the action alternatives would be minor in the short term and negligible in the long term.

4.10.1.3 Threatened, Endangered, and Candidate Species

Information regarding project-related impacts to threatened, endangered, and candidate species is provided in **Appendix B**.

4.10.2 Effects From Alternative 3

Under the no-action alternative wildlife and waterfowl would continue to use the habitat in the project area as they do under current conditions. However, should dam failure occur there would be a loss of habitat and potential dislocation of wildlife and waterfowl. Impacts on terrestrial wildlife, and waterfowl under the no-action alternative would be negligible, with the potential to become major and significant under dam failure. Under dam failure in the long term, a more natural flow regime would become re-established and would ultimately benefit riparian vegetation and wildlife.

4.10.3 Cumulative Effects

The proposed project would inundate wildlife habitat in the area upstream of the dam, resulting in short-term displacement of fauna currently using this area. White-tailed deer, in particular, would be competing for fewer acres of protective cover and thus be more exposed to natural predation and hunting pressure. If the TRR project was constructed during the same timeframe, a total of about 18 miles of riparian and upland habitat would be undergoing disturbance over about 2 years. Increased pressure on wildlife resources would occur due to additional vehicular traffic and higher population and use of the reservoir and downstream. Cumulative impacts on big game and waterfowl could be moderate to major in the short term.

4.11 VEGETATION

4.11.1 Effects Common to the Action Alternatives

4.11.1.1 Increased Reservoir Water Surface Elevations

Potential impacts to vegetation would result from repair of the Tongue River Dam, operation of the dam to raise reservoir water levels by 4 feet during typical years, development of aggregate sites, construction of approximately 3.4 miles of new county road alignment, widening the existing county road, development of wetland and riparian mitigation sites, and relocation of Tongue River State Park. For discussion of impacts to vegetation from proposed enhancement, see Implementation of Fish and Wildlife Habitat Enhancement Features.

Repair of the spillway and operation of the dam would increase reservoir water levels to above elevation 3,425 feet for several months in a typical year (**see Figure 4-4**), inundating and killing existing shoreline vegetation below that elevation. Existing stands of four common riparian woody plant species (cottonwood, green ash, peachleaf willow, and sandbar willow) and herbaceous plants present in this zone likely would be eliminated. Some of the vegetation growing below elevation 3,429 feet (1,334 acres of riparian and wetland communities) would also be killed due to inundation for substantial periods during the growing season. Western wheatgrass and silver sage communities below elevation 3,429 feet would die within a few years as would Rocky Mountain juniper and ponderosa pine growing below elevation 3,431 feet. Although reservoir water levels would not exceed 3,429 feet, some plants above this elevation would be jeopardized. Wave action and water-saturated soil, from capillary movement within the rooting zones of upland species such as juniper and ponderosa pine, would eventually kill these plants. Unlike cottonwood and

willow, juniper and ponderosa pine cannot survive water-saturated soils within their rooting zones for extended periods during the growing season.

Part of the vegetation losses resulting from increased reservoir water levels would be offset due to re-establishment of riparian communities around the reservoir margin in a narrow zone from about elevation 3,429 to 3,431 feet. Wave action and increased soil moisture from upward capillary movement would create an environment favorable to the growth of sandbar and peachleaf willow and Great Plains cottonwood. Wave action would create nonvegetated, bare soil that would be moist for most of the growing season, and exposed to full sunlight. These conditions are ideal for seed germination and growth of willow and cottonwood.

Although riparian vegetation would quickly establish on the new reservoir margin, the elevation zone amenable to colonization (3,429 to 3,431 feet) would be considerably smaller than the zone now vegetated by riparian communities (3,417 to 3,425 feet). Not only would the elevational zone be reduced, but the surface area of reservoir margin suitable for establishment of riparian vegetation would be disproportionately reduced.

Under existing conditions, the topography of the southern portion of the reservoir shoreline is characterized by relatively large areas of nearly flat or gently sloping ground. These gently sloping shorelines are subject to inundation and exposure with fluctuations of water levels of only a few feet.

Under the action alternatives, the existing large, nearly flat areas typically would be inundated (see **figures 2-3, 4-1, and 4-4**). Due to steeper topography above elevation 3,425 feet, the new reservoir shoreline would consist of less gently sloping ground; consequently, minor water-level fluctuations would not expose disproportionately large shoreline areas amenable to growth of riparian vegetation. Based on studies conducted by the Montana Riparian Association at the University of Montana, Miles and Hansen (1992) determined that the elevational band between 3,425 and 3,429 feet has only 70 percent of the area of the band between 3,420 and 3,425 feet.

Not only would shoreline habitats capable of sustaining riparian vegetation be reduced, but growth of woody vegetation on the reservoir margin might be inhibited by ice formation on the reservoir during winter and ice scour during spring breakup. During typical years, with proposed operation of the reservoir (see **Figure 4-4**), water levels would gradually increase from 3,425 feet in October to maximum pool (3,429 feet) in February and March. During the latter part of March, and through April, reservoir levels would be lowered to 3,425 feet. Water-level fluctuations, while the reservoir was frozen, would probably cause ice to shift and shear off or uproot woody plants frozen in the ice. Plants growing below elevation 3,429 feet would likely be vulnerable to damage and mortality from shifting ice.

Removal of existing vegetation from increased reservoir water levels, wave action, and ice movement may favor the spread of existing salt-cedar, a noxious, non-native shrub that aggressively colonizes disturbed riparian areas, and displaces more desirable native plants. Dense stands of willows and cottonwoods are less likely to be rapidly colonized by salt-cedar than are bare non-vegetated shorelines, because established vegetation competes with invading species for sunlight, nutrients, and growing space. If salt-cedar was not controlled, then there could be major long-term impacts to existing native vegetation. If it was controlled, then short-term impacts on salt-cedar and non-target species would occur, however, long-term impacts would be beneficial.

Proposed placement of about 91,000 cubic yards of riprap along portions of the reservoir margin would affect re-establishment of riparian vegetation. Little vegetation would likely grow on sites armored with riprap. Impacts on vegetation from increased reservoir water surface elevations associated with action alternatives would be moderate in the short and long terms.

4.11.1.2 Road Construction

Construction of about 3.4 miles of new county road alignment (**see Figure 2-3**) would directly remove about 33 acres of native vegetation, assuming an average disturbance width of 80 feet (**see Figure 2-6**). Native plant communities that would be destroyed are: 19 acres of big sagebrush/grassland, 3 acres of riparian western wheatgrass, and 11 acres of Rocky Mountain juniper/grassland. Potential widening of the existing road would destroy additional areas of native vegetation, primarily open forest communities of Rocky Mountain juniper and ponderosa pine. Construction of new roads and widening of existing roads would increase the potential for introduction and spread of noxious weeds. Vehicles traveling from areas with noxious weed infestations often carry and disperse weed seeds to uninfested areas. Impacts on vegetation from road construction would be minor in the short and long terms if weeds did not become established. If weeds replaced desirable native plants, local impacts to vegetation would be major in the short and long terms.

4.11.1.3 State Park Relocation

Tongue River State Park would be relocated upslope from its present location to accommodate increased reservoir water levels. Construction of new facilities (e.g., campsites, boat launch, latrines, and waste disposal stations, and concessions) would directly remove vegetation, mostly big sagebrush/grassland. In addition to direct removal of vegetation (about 23 acres), plant communities in and adjacent to the campground would be adversely affected by human trampling. Disturbance of native plant communities and a large influx of vehicles would increase the potential for spread of noxious weeds. Impacts of state park relocation on vegetation would be minor in the short and long terms.

4.11.1.4 Construction Staging Area

The construction staging area, proposed to be located downstream of the dam and at an existing fishing access site, would remove vegetation or severely degrade 36 acres of vegetation by compaction and disturbance from construction activities. Vegetation in the staging area consists of cottonwoods and other riparian species. Efforts (e.g., fencing) would be undertaken to preserve as many mature cottonwoods in the staging area as possible. Impacts to vegetation at the construction staging area would be major in the short term and minor in the long term unless noxious weeds replaced desirable native plants. Then local impacts to vegetation in the staging area would be major in the long term.

4.11.1.5 Wildlife - Wetland Mitigation

Wildlife and wetland mitigation (see Chapter 2, Mitigation and Monitoring) would include construction of wetlands on sites currently vegetated with a predominance of upland plants. The conversion of upland sites to wetlands would result in the loss of plant species not adapted to anaerobic, water-saturated soils and replacement of these plants with species adapted for life in marshes, ponds, and other sites with abundant free water or shallow ground water within their rooting zones.

Proposed eradication or control of salt-cedar would affect development of plant communities on reservoir shorelines. If herbicides were used, non-target plant species could be killed. If physical methods were used, seedlings and saplings of cottonwoods and willows, also likely to be present at sites with salt-cedar, could be adversely affected over the short term. Over the long term, removal of salt-cedar would allow desirable riparian native plant communities, essential wildlife habitat, to establish without additional competition.

4.11.1.6 Ethnobotanical Resources

None of the 62 ethnobotanical plant species inventoried in the vicinity of the Tongue River Reservoir and valued by Native Americans are rare or uncommon in eastern Montana. Most of these plants are readily accessible to people involved with collection and use for ethnobotanical purposes and none are restricted to habitat below elevation 3,440 feet or 12 feet above the new high-pool elevation (Aaberg and Tallbull 1993). The proposed action would have negligible impacts on regional ethnobotanical resources.

4.11.2 Effects Unique to Alternative 1

Riparian vegetation downstream from the dam could be affected if major floods were greatly attenuated. Flood frequency and magnitude downstream from the dam would differ between action alternatives; consequently, potential impacts to riparian vegetation downstream from the dam would also differ.

Flood peaks would be more frequent and of greater volume with a labyrinth weir spillway than with the existing spillway. Increased frequency and magnitude of floods would likely alter stream channel morphology through scouring and overbank flooding. Overbank floods would also deposit alluvium and create favorable conditions for regeneration of cottonwood and willow communities. Increased frequency of overbank flooding associated with Alternative 1 would probably favor maintenance of riparian communities dominated by cottonwood and willow.

Extraction of soil and rock (aggregate) for construction would destroy up to 60 acres at aggregate Site No. 1. Vegetation that would be lost at Site No. 1 is predominantly big sagebrush/grassland. Some of the area at this site has been used previously for extraction of earth and rock and has been altered by a network of roads. Impacts of the labyrinth weir alternative on downstream and aggregate source Site No. 1 vegetation would be minor in the short and long terms.

4.11.3 Effects Unique to Alternative 2

With Alternative 2, impacts on riparian vegetation downstream from the dam would not appreciably change from existing conditions. The reconstructed dam and spillway would contain floods and discharge flows of similar magnitude and frequency to those occurring under existing conditions. Existing stands of cottonwoods on river terraces that have been protected from floods since construction of the dam would decline and eventually become dominated by shrubs, green ash, box-elder, Rocky Mountain juniper and, possibly, Russian olive, an aggressive, non-native tree.

Cottonwood communities on river bars, shorelines, and low portions of floodplain that are inundated by 25-year flood events or greater would continue to remain in early stages of ecological succession due to periodic high streamflows.

Extraction of soil and rock (aggregate) for construction would destroy up to 70 acres of vegetation (up to 60 acres at Site No. 1 and up to 10 acres at Site No. 2). Vegetation that would be lost at Site No. 2 consists of cottonwoods and associated riparian shrubs and herbaceous species. Impacts of the RCC alternative on vegetation downstream and at aggregate source sites nos. 1 and 2 would be minor in the short and long terms.

4.11.4 Effects From Alternative 3

Under the no-action alternative, plant communities would be maintained in their existing state. Cottonwood communities on downstream river terraces that have been precluded from periodic inundation by dam flood control would continue to age. Trees 70 years old and older would die. Vegetation on reservoir margins would be maintained in early stages of ecological succession by periodic inundation and wave action during periods of high water. Impacts of the no-action alternative on vegetation would be negligible both in the short and long terms. In the event of dam failure, portions of land exposed by draining of the reservoir initially would become vegetated by plants with the capability to colonize unvegetated substrate. There would be a high potential for noxious weeds to become established because of the very large area of disturbed habitat that would be available for exploitation. Eventually, the river would re-establish a channel through the exposed reservoir bottom and riparian vegetation dominated by willow and cottonwood would develop. Over time, native plants would become established on upland sites and prairie habitats would occupy most of the drained reservoir.

4.11.5 Cumulative Effects

Construction of Tongue River Railroad and the proposed project could cumulatively affect vegetation. Bridge crossings of the Tongue River and construction of the railroad through riparian vegetation would cause long-term losses of cottonwood, willow, and herbaceous plant communities within Tongue River Basin. Upland plant communities destroyed by railroad construction would incrementally increase regional losses of upland vegetation and, cumulatively, add to losses of vegetation that would be realized with the Tongue River Basin project. Cumulative impacts on vegetation would be moderate when considered in combination with the impact of Tongue River Railroad.

4.12 BIODIVERSITY

4.12.1 Effects Common to the Action Alternatives

Impacts on biological diversity could result from the habitat alterations that would encourage the proliferation of noxious weeds, including salt-cedar on the reservoir shoreline. Typically, noxious weeds replace native plant species and form dense populations with low species and habitat diversity. Reductions in diversity of wildlife populations using habitats degraded by noxious weed infestations would also occur. For further discussion of impacts to Biodiversity, see Implementation of Fish and Wildlife Habitat Enhancement Features.

The proposed project would probably not affect species diversity in aquatic habitats if adequate streamflows were maintained in the Tongue River and adequate volumes maintained in the reservoir. Native species would continue to coexist with introduced species.

Impacts to biological diversity would be minor in the short term and minor to moderate and beneficial in the long term (life of the project or longer) both locally and regionally. Impacts on biological diversity would depend on locations and types of mitigation and enhancement to be implemented. If currently disturbed lands, with reduced ecological functions and values were used for creation of wetlands or were enhanced by revegetation with a diverse mix of native plants, species diversity would increase and the project would be consistent with the objectives of ecosystem management.

4.12.2 Effects From Alternative 3

Taking no action would likely maintain species diversity at existing levels. In the event of dam failure, aquatic habitat would revert to terrestrial habitat. Fish and other aquatic organisms living in the reservoir would be replaced by birds, mammals, and other fauna capable of occupying terrestrial habitats. Reversion of habitat dominated by non-native species (i.e., non-native fish in the reservoir) to habitat occupied by predominantly native species would be consistent with the goals of ecosystem management if the economic and recreational values associated with the Tongue River Reservoir are disregarded.

4.12.3 Cumulative Effects

Mitigation measures to convert native prairie habitats to artificial wetlands would cumulatively reduce amounts of native prairie habitat remaining in the Northern Great Plains. Agricultural development, overgrazing, mining, residential development, and other activities have reduced native prairie and associated wildlife populations which have a strong affinity for native grasslands and shrublands. Cumulative impacts to biological diversity under the action alternatives would be negligible if upland prairie habitats were maintained. If they were converted to wetland sites, impacts would be minor given the relatively small acreages of potentially altered habitat.

4.13 SOCIAL CONDITIONS

4.13.1 Effects Common to the Action Alternatives

Impacts to community service providers, social well-being of residents, population, and housing resources occur when a significant number of workers and their families move into an area as a result of jobs either directly or indirectly created by a project and its related activities. As a result of the TERO agreement (see Economic Environment, Employment and Personal Income), few, if any, new people are expected to move into the area due to employment opportunities created by the Tongue River Basin project. Therefore, construction or operation of the project would have negligible short- or long-term impacts on the population and demographic characteristics of the area. Negative short-term impacts, however, may be realized during preconstruction and construction phases due to increased commuter and truck traffic on local roads. Increased traffic may result in more traffic accidents, stressing police, ambulance, and emergency room services. Short-term positive impacts due to increased employment opportunities for Northern Cheyenne members may

enhance the social well-being of workers and their families. However, the impact on social-well being would be minor since only a 0.2 percent employment increase would occur (see Employment and Personal Income). No long-term impacts to community services, housing, and social well-being are expected. Impacts of action alternatives on social conditions would be minor and beneficial in the short term and negligible in the long term. For further discussion on social conditions, see Implementation of Fish and Wildlife Habitat Enhancement Features.

Executive Order 12898 was issued to assure that "environmental justice" be considered in each federal EIS. The purpose of the order was to assure that no particular socioeconomic group, in particular low-income or minority, suffered a disproportionate share of impact from a federal project. Given the 1) relatively minor amount of employment associated with the project, 2) short-term nature of economic impact on agricultural practices due to construction drawdown, 3) TERO agreement, 4) agricultural mitigations proposed, and 5) location of the project away from lands associated with a specific socioeconomic group, environmental justice issues associated with this project appear to be negligible.

In addition, one of the primary intentions of carrying out the project is to provide beneficial water storage for the Tribe. Employment impacts are also beneficial both within and out of the basin. With the TERO agreement in place, a target of 75 percent of the workforce would be hired from the Northern Cheyenne Tribe, a minority group with high unemployment and lower median incomes.

4.13.2 Effects From Alternative 3

Under Alternative 3, social conditions would maintain the status quo except as influenced by other future activities. Potential major and significant impacts could result from a dam failure as described in Hydrology. Significance is determined from the probable loss of lives and property damage. Impacts of the no-action alternative on social conditions would be negligible in the short and long terms with the potential to become major and significant in the short term under dam failure.

4.13.3 Cumulative Effects

Cumulative impacts would result from construction and operation of the TRR. Construction activities would increase commuter and truck traffic on local roads which may result in more traffic accidents, stressing police, ambulance, and emergency room services. Long-term negative impacts would include increased fire hazards, stressing fire protection services.

4.14 ECONOMIC CONDITIONS

4.14.1 Effects Common to the Action Alternatives

4.14.1.1 Employment and Personal Income

Estimated project employment would include jobs related to preconstruction, construction, and mitigation activities. Preconstruction work would include road improvement, aggregate extraction and

preparation, and riprap hauling and placement, and would last about 18 months. Activities related to mitigation include coal-mine-flood-damage reduction, riparian planting, fencing, and state park improvements.

Seventy-five percent of all employees hired for preconstruction, construction, and mitigation are expected to be Native Americans hired from the Northern Cheyenne Tribe. A majority of the Native Americans hired to work on the dam rehabilitation are expected to be hired from the Northern Cheyenne Indian Reservation and most likely would commute to work at the project site. The remaining employees (about 10 to 15 workers) would most likely be hired from outside the study area, depending on the location of the project contractor and employment requirements.

In addition to the estimated direct jobs created, some secondary employment, primarily in the trades and services and industrial sectors, may be created by construction-related activities. Using indirect to direct employment ratios associated with the construction of mineral developments in rural areas of Montana and North Dakota, about two or three secondary jobs (for about 1 year) may be created for each direct job associated with rehabilitation of the dam (Gilmore et al. 1982).

Indirect and direct employment due to construction-related activities is estimated to impact total projected Tongue River Basin employment by less than 0.2 percent (25 to 30 employees) over the construction period. The impact on Native American employment in the basin (assuming 75 percent of the employees are hired from the Northern Cheyenne Tribe) would be about 2 percent for about 1.5 years.

Wages and salaries (1993 dollars) due to construction-related activities should total between $1.7 and $1.9 million for the action alternatives. In addition, further income may be realized from the local purchase of supplies and equipment by the construction company. Annual earnings statistics are not collected by Indian Reservation or by Tribe. However, if 75 percent of the employees are Northern Cheyenne, tribal earnings should increase by about $1.4 million over the construction period.

Concession income associated with camping and fishing activities at recreation sites is likely to be negatively affected due to reduced visitation during construction. In 1992, gross concession income totaled about $43,000. Expected income losses could range from no loss to full loss of gross income for concessionaire income at the Tongue River recreation facilities.

Based on the foregoing information and assumptions, the short-term impacts on basin employment and personal income are expected to be minor and beneficial. Short-term impacts on Northern Cheyenne employment and income are expected to be beneficial and moderate. Long-term Tongue River Basin and Northern Cheyenne employment and income benefits are expected to be minor.

4.14.1.2 Agricultural Economy

During construction, the water level of Tongue River Reservoir would be lowered which may impact the amount of water that would be available for downstream users. About 4,000 acres of hay, silage, and small grain croplands that require full irrigation could be affected by construction at the dam site. In addition, 11,000 acres that receive partial irrigation from water stored in the reservoir, may not have sufficient water

available for irrigation. Construction of the spillway may affect irrigation for most of two growing seasons. Agricultural production losses would depend on the amount of precipitation during the construction period.

Once construction was completed and water levels were attained in the reservoir, water would again be available for the 15,000 acres that depend on the reservoir for irrigation. Additional water also would be available for irrigation projects supported by the Northern Cheyenne. Estimates of increased agricultural sales are difficult to assess since the Northern Cheyenne have current unused water rights. Once the spillway was complete, the Tribe would have up to 40,000 afy of water available for irrigation during typical years. If all water rights were used and about 10,000 acres of land were available to be irrigated, the water potentially could be worth nearly $1.5 million (1990 dollars) per year in increased agricultural production.

Raising the water level of the reservoir and the potential land acquisition by DNRC could remove up to 4,600 acres of agricultural land from production in Big Horn County, Montana. Additional acreage could be lost to production due to acquisition for wildlife mitigation and enhancement. However, less than 0.1 percent of agricultural land in the county would be affected with little impact on total agricultural production in the basin.

Estimated impacts to the agricultural economy over the 2-year period range from no loss to $2.0 million depending on available moisture. Impact losses to total agricultural sales in the Montana Tongue River Basin due to dam rehabilitation are estimated to be less than 1.0 percent per year. (See Chapter 2, Proposed Mitigation and Monitoring, for a discussion of agricultural mitigations.)

Based on the foregoing information and assumptions, the short-term impacts on the basin agricultural economy are expected to be negative, but not significant. Long-term impacts to the basin agricultural economy are expected to be minor. Long-term impacts to the Northern Cheyenne could be major, beneficial, and significant depending on their ability to use or sell additional water (rights). Impacts of action alternatives on the agricultural economy would be minor in both the short and long terms.

4.14.1.3 Area Coal Mining

Following rehabilitation of the dam, the reservoir water levels typically would increase above current levels. The increased water levels would result in more ground water seepage into coal mine pits. Measures proposed to mitigate economic effects on mines would be accomplished using additional power for pumping and greater pumping capacity, additional sediment pond capacity, and obtaining permission to increase annual discharge under the Montana Pollutant Discharge Elimination System from the Montana Department of Health and Environmental Sciences. (See Chapter 2, Proposed Mitigation and Monitoring for a discussion of coal mine mitigations.) Impacts of action alternatives on area coal mining would be negligible in the short and long terms.

4.14.1.4 Public Sector Fiscal Conditions

Little in-migration of construction workers is expected over the duration of the project because of the 75 percent target for workers to be hired from the Northern Cheyenne Tribe. Consequently, there should be little demand for additional services from local governments due to the workforce at the dam site.

Costs to local governments in the study area could occur due to deterioration and maintenance requirements for county and state roads. In particular, County Road No. 380, Secondary Highway 314, Secondary Highway 338, and I-90 would all be used extensively in hauling materials and aggregate for rehabilitation of the dam.

Costs to state and federal governments would occur from settlement payments related to the Water Rights Compact signed by the State of Montana, the United States Government, and the Northern Cheyenne Tribe. The state's share of project costs is about $21.8 million.

Costs to the federal treasury for the Tongue River Dam rehabilitation project and the settlement of the Northern Cheyenne reserved water rights exceed $56.5 million. This figure includes $21.5 million for the Tribal Development Fund, $31.5 million for the federal share of the dam project, and $3.5 million for fish and wildlife habitat enhancement. The figure does not include revenue lost to the U.S. Treasury, federal costs for environmental compliance and mitigation, federal costs for operation, maintenance, and replacement on the Tongue River Dam, or any costs associated with the Tribe's allocation of Bighorn Reservoir water. State and federal agencies would experience minor fiscal impacts from paying for coal mine and agricultural mitigation.

During construction, Big Horn County would realize additional taxable valuation on construction equipment located at the dam site. Further governmental revenues would be gained from use/fee taxes such as fuel, gaming, and permits. After construction, some taxable valuation could be lost due to irrigated lands being converted to a non-irrigated status.

Taxable valuation related to lands could be lost due to the proposed project and related mitigation activities. Assuming 1,000 to 4,600 acres were lost from assessed lands, Big Horn County (Montana) would have its taxable valuation reduced by less than 0.01 percent. After rehabilitation was completed and water levels restored to the reservoir, increased taxable valuation from irrigation of additional crop and hayland could occur.

During rehabilitation of the dam, DFWP would most likely lose revenues associated with camping and day use of recreational facilities and loss of concessionaire payments at Tongue River State Park. In 1993, DFWP recreational fees from use of the Tongue River Dam facilities totaled $41,228 and concessionaire payments were $1,500.

Based on the foregoing information and assumptions, the short- and long-term impacts on local government sector fiscal conditions are projected to be minor. Short-term impacts to state and federal fiscal conditions would be significant, due to the costs associated with rehabilitation. Long-term fiscal impacts would be potentially beneficial and significant, as the liability associated with dam failure would be lessened. For a further discussion on impacts to economic conditions, see Implementation of Fish and Wildlife Habitat Enhancement Features.

4.14.2 Effects Unique to Alternative 1

Construction activities would include site work and reclamation, spillway and low level outlet works construction, and would last for about 18 months. Construction employment would peak at 26 employees and

would average about 15 employees. Mitigation employment is expected to last about 1 year and include a maximum of four skilled and ten semi-skilled jobs. Impacts of Alternative 1 on employment would be minor in the short term and negligible in the long term. Wages and salaries would total about $1.9 million. Native American earnings are estimated to total $1.5 million over the project period.

4.14.3 Effects Unique to Alternative 2

Under Alternative 2, construction employment would peak at 16 employees and average about 10 to 12 employees for 15 months. Wages and salaries (1992 dollars) would total $1.7 million. Native American earnings are estimated to total $1.3 million over the project period. Impacts of the RCC alternative would be minor in the short term and negligible in the long term.

4.14.4 Effects From Alternative 3

Under the no-action alternative employment and personal income, the agricultural economy, area coal mining, and public sector fiscal conditions in the study area would remain at current levels. Because of the hydraulic and structural deficiencies of the spillway, the dam could fail causing an event that would threaten lives and damage property. DNRC estimated that full economic losses would total between $300 and $500 million (Montana Department of Natural Resources 1981). Under the dam failure scenario, both short- and long-term impacts to employment and personal income, the agricultural economy, and public sector fiscal conditions would be significant. Short- and long-term impacts to employment and personal income would be significant due to current crop losses from flooding and lost future income due to farms not being able to irrigate.

Impacts of the no-action alternative on employment, personal income, the agricultural economy, and public sector fiscal conditions would be negligible in the short and long terms with the potential to become major and significant under dam failure.

4.14.5 Cumulative Effects

The cumulative effects associated with the Tongue River Dam and TRR would be moderate for employment if the two projects were to be constructed concurrently. TRR Company employment projections total 202 to 395 during construction, for a cumulative total of 223 to 429 employees in the short term. There would be no cumulative long-term impacts. Cumulative short-term earnings would also be moderate within the basin over the short term.

4.15 TRANSPORTATION

4.15.1 Effects Common to the Action Alternatives

Short-term truck and other motor vehicle traffic would be generated during construction by: 1) the hauling of construction materials and equipment from outside the project area; 2) hauling of aggregate and borrow material from sources in the project area; 3) movement of materials within the construction site; and

4) commuting of laborers and others between the construction site and Ashland, Birney Village, Lame Deer, and Busby, Montana, and Sheridan, Wyoming.

As indicated on **Table 4-8**, the following construction materials and equipment would be transported to the site by one or a combination of the following methods:

- by truck from a location near Sheridan, Wyoming, through Sheridan, Wyoming then via Secondary Highway 338 (S-338), Secondary Highway 314 (S-314), and County Road No. 380;
- by rail to Sheridan, Wyoming then by truck via Secondary Highway 338 (S-338), Secondary Highway 314 (S-314), and County Road No. 380; or
- by rail to sidings at the Decker coal mines then by truck via Secondary Highway 314 (S-314) and County Road No. 380.

Materials obtained and hauled to the dam from within the project area would include:

- surfacing aggregate for improvements to County Road No. 380 (mainly from Site No. 1); and
- concrete aggregate from Site No. 1 for construction of the improvements at the dam (see **Table 4-9**).

4.15.1.1 Local Roads

Figure 3-6 shows the total daily traffic volumes and the total trucks per day that would occur on County Road No. 380 during the peak traffic period. The peak traffic period is expected to occur for about 6 weeks during mid- to late-summer 1997 when the production and placement of concrete would be in full operation. It is assumed, for these projections, that the hauling of surfacing aggregate from Site No. 1 for County Road No. 380 improvements would not occur during this time. Since most riprap quantities are for erosion protection on Secondary Highway 314, little or no riprap would be hauled on County Road No. 380. Total traffic between Site No. 1 and the dam would be about six times existing volumes and truck traffic; about 110 vehicles per day (vpd). This volume of traffic is well within road design capacity.

The increase in construction-related traffic volumes, particularly trucks, when summer recreational traffic is heaviest may cause the potential for conflicts and accidents, and increased wear on the roadway. The wear would be most significant on steep grades, sharp corners, and during times when the roadway was wet or saturated when deep rutting and integration of gravel with subgrade materials may occur.

Excavation for construction of embankments for relocated sections of County Road No. 380 would be required. This, and other related activities, would generate substantial heavy equipment and other traffic on the roadway during roadway construction. Construction activities would temporarily (up to 1.5 years) obstruct access to East Shore Road.

TABLE 4-8
Materials From Outside Project Area

MATERIAL	QUANTITY	TRUCK LOADS Total/Daily	TRAIN CAR LOADS Total/Daily
ALTERNATIVE 1 (LABYRINTH WEIR)			
Riprap	91,000 C.Y.	9,100/30	1,800/6
Portland Cement	15,400 Tons	770/25	160/10
Reinforcing Steel	2,300 Tons	115/5	25/5
Other	2,000 Tons	100/2	20/1
Totals, Alt. 1		9,395/62	2,005/22
ALTERNATIVE 2 (RCC SPILLWAY)			
Riprap	91,000 C.Y.	9,100/30	1,800/6
Portland Cement	12,100 Tons	605/20	120/8
Reinforcing Steel	695 Tons	35/4	7/1
Other	1,400 Tons	70/2	14/1
Totals, Alt. 2		9,810/56	1,941/16

Source: Department of Natural Resources and Conservation 1994.

TABLE 4-9
Materials From Within Project Area

MATERIAL	QUANTITY	TRUCK LOADS Total/Daily
ALTERNATIVE 1 (LABYRINTH WEIR)		
Surfacing Aggregate	19,000 C.Y.	1,900/63
Concrete Aggregate	92,000 Tons	4,600/23
Totals, Alt.1		6,500/86
ALTERNATIVE 2 (RCC SPILLWAY)		
Surfacing Aggregate	19,000 C.Y.	1,900/63
Concrete Aggregate	14,000 Tons	700/14
Totals, Alt. 2		2,600/77

Source: Department of Natural Resources and Conservation 1994.

Substantial movement of materials and various other construction operations would occur within the construction site including excavation and embankment materials, mixed concrete, and other materials. Temporary haul roads would be used for this purpose within the staging area.

Twelve areas of County Road No. 380 and the one area of East Shore Road would be inundated by the higher water elevations. Impacts of the action alternatives on local roads would be moderate in the short term and negligible in the long term.

4.15.1.2 Secondary Highways

Figure 3-7 shows the total daily traffic volumes and the total trucks per day that would occur on area highways during the peak traffic period assuming that rail was not used to transport major construction materials and that a site near Sheridan, Wyoming was found for riprap. This peak would be expected to occur for about 4 to 6 weeks during mid- to late-summer 1996 when the hauling of both riprap and concrete materials (cement and reinforcing steel) are underway. During the remainder of the construction period, about half as much truck traffic would be generated by the construction project on area highways.

Most of the generated truck traffic would use S-314, from County Road No. 380 to the Montana/Wyoming border and S-338 from the border to I-90 and Sheridan. Peak increases in truck traffic would approximately double. There is more than adequate capacity to accommodate these volumes without adversely affecting the existing level-of-service and pavement structure.

There is a total of approximately 2.6 miles along eight different sections of S-314 where increased water levels due to a 100-year flood would be above the toe of the embankment of the existing roadway (Western Water Consultants 1993). None of the existing roadway surface or base course would be impacted. In areas where the higher water elevation would be above the toe of existing roadway embankments, erosion protection would be constructed by installing riprap or vegetative protection from elevation 3,432 feet, down the existing embankment slope to a distance of 12 feet outside the toe of the slope. The riprap would be placed over suitable filter fabric which would be placed on the ground after vegetation was removed.

Impacts of action alternatives on secondary highways would be minor in the short term and negligible in the long term.

4.15.1.3 Off-road Travel

Off-road travel would not be affected by the proposed construction project except in the immediate area of the construction site or where land is inundated by new water levels. Impacts of action alternatives on off-road travel would be negligible to minor in the short and long terms.

4.15.1.4 Railroads

Assuming the Decker coal mines' siding was used, the 16 to 22 carloads per day of construction materials that may be generated by the proposed project represent a relatively small percentage of the 400 to 500 carloads of coal per day that are hauled from the mines. Therefore, little impact on the branch line would be expected. After the summer of 1996, an average of six carloads of riprap per day would be hauled to the

project area. It has not been determined at this time if the Decker mines can allow the use of the sidings or if BN Railroad can provide the rail cars needed.

If a rail load-out at Sheridan were used, adequate sidings and other facilities exist there for unloading major construction materials for subsequent haul by truck to the project site. Fifty-six to 62 truck trips per day (**see Table 4-8**) would be required to travel through a three-to-four block residential area in Sheridan to reach major streets and highways. Impacts of this increase in truck traffic may include increased noise levels (see Noise), increased dust, vehicle exhaust and other vehicle-related air pollution emissions, increased wear and damage to the street system, and reduced safety.

Impacts of action alternatives on use of railroads would be minor in the short term and negligible in the long term. Impacts on Sheridan related to use of railroads (if this option were used) would be moderate in the short term and negligible in the long term.

4.15.2 Effects Unique to Alternative 1

The construction work force would be the largest during mid- to late-summer 1997 for about 1 month. During this time, the estimated workforce would be 26 persons for Alternative 1. These workers and related services would generate approximately 240 vpd (mostly passenger cars and pickups).

A total of 7,500 trucks would use County Road No. 380 during construction of the proposed project, resulting in an increase of 15,000 truck trips (one way loaded and one way empty).

Assuming that most major construction materials would be hauled to the Decker coal mine sidings by rail, Alternative 1 would generate up to 22 rail carloads per day. This peak traffic period would occur for 4 to 6 weeks during mid- to late-summer, 1997 while construction materials were being hauled.

Assuming that most major construction material would be hauled from Sheridan, Wyoming, 62 truck trips per day would be required to travel through three to four blocks of a residential area in Sheridan to reach major streets and highways.

Impacts from Alternative 1 would be moderate in the short term and negligible in the long term.

4.15.3 Effects Unique to Alternative 2

It is projected that the construction work force would be largest (up to 16) during mid- to late-summer 1997 for about 3 months. It is estimated that these workers and related services would generate approximately 200 vpd (mostly passenger cars and pickups).

It is estimated that a total of 2,600 trucks would use County Road No. 380 during construction of the proposed project which would result in an increase of 5,200 truck trips (one way loaded and one way empty).

Assuming that most major construction materials would be hauled to the Decker coal mine sidings by rail, Alternative 2 would generate up to 16 rail car loads per day. This peak traffic period would occur for 4 to 6 weeks during mid- to late-summer, 1996.

Assuming that most major construction material would be hauled from Sheridan, Wyoming, 56 truck trips per day would be required to travel through three to four blocks of a residential area in Sheridan to reach major streets and highways.

Impacts from Alternative 2 would be moderate in the short term and negligible in the long term.

4.15.4 Effects From Alternative 3

Under the no-action alternative, local road and secondary highway configurations would remain the same until a future need arose to change them. Traffic levels would follow growth trends independent of those projected for the project. Off-road travel would continue and railroads would remain under current conditions. Impacts of the no-action alternative on local roads, secondary highways, off-road travel, and railroads would be negligible in the short and long terms. Failure of Tongue River Dam would inundate and damage many transportation facilities including numerous private and county roads located along the stream valley to Miles City, local streets and roads at Ashland, BN Railroad, and numerous local streets and roads at Miles City (see **Table 4-10**). Dam failure would result in major and significant short- and long-term impacts to transportation facilities.

TABLE 4-10
Transportation Facilities Potentially Affected by Failure of Tongue River Dam

Highway	From Milepost to Milepost	Reference Point
S-566	3.6 - 9.1 18.1 - 22.2 24.4 - 38.5	S-566 crosses the Tongue River at Milepost 31.4
U.S. 212	60.9 - 62.6	U.S. 212 crosses the Tongue River at Milepost 61.4
S-447	45.5 - 52.7	S-447 crosses the Tongue River at Milepost 52.5
S-332	0/1 - 12.5 17.2 - 22.6 27.8 - 29.4 33.0 - 50.2	S-332 crosses the Tongue River at Milepost 39.6
MT 59	6.3 - 9.8 10.5 - 11.7	
I-94	136.9 - 137.9	I-94 crosses the Tongue River at Milepost 137.5
I-94 Business Route, Miles City	1.8 - 2.8	I-94 Business Route crosses the Tongue River at Milepost 2.3
U-8002 (5th Street) in Miles City	N/A	0.4 miles between Washington and Bridge streets
U-8003 (Pleasant Street) in Miles City	N/A	0.1 miles between 5th Street and MT 59
U-8005 (Bridge Street) in Miles City	N/A	0.1 miles between 5th Street and 7th Street

4.15.5 Cumulative Effects

Cumulative traffic effects would occur if the TRR was constructed concurrently with the proposed project. Increased traffic would be most noticeable on roads between the project area and Sheridan due to transport of building materials from the Sheridan area.

The TRR EIS has not identified specific roads or traffic volumes associated with its construction. Also, the actual timing of construction is not known. The railroad would most likely construct the subgrade using on-site materials and then use rail to bring in gravel base course, ties, rails, and bridge components, directly to the railroad bed. The railroad would be incrementally extended from the old and newly built line. TRR company also is planning to use a parallel construction road. County roads and highways connect to this road. County Road No. 380 and Secondary Highway 314 (S-314) could be used by TRR workers concurrently with workers for the Tongue River Dam project, potentially increasing vehicle trips by an unknown amount. Cumulative effects from the TRR project and the Tongue River Dam project on transportation would be minor to moderate in the short term and negligible in the long term.

4.16 RECREATION

4.16.1 Effects Common to the Action Alternatives

4.16.1.1 Access Restrictions

Tongue River Reservoir serves as a unique recreation resource in the region and would experience short-term impacts during construction. Restricted access during the 2-year construction and reclamation phases of the project would eliminate the use of recreation areas including the Tongue River Canyon fishing access site and campground below the dam. Park-related recreation from the dam construction site to aggregate Site No. 1 would also be eliminated during construction.

The existing fishing access site would be a parking area for construction personnel with public access controlled by a security gate and rerouting of the existing county road. Opportunities for fishing, boat launching, and camping at the access site directly below the dam would be lost due to construction-related activities.

Travel would be restricted from aggregate Site No. 1 to the construction staging area. The proposed restriction would limit vehicle access to most areas along the reservoir from the north shore of Sand Point to the dam. Existing campsites in the Neck and Cormorant Bay areas, as well as the northern shore of the reservoir would be inaccessible by road.

In total, an estimated 71,000 visitor hours would be lost due to the proposed access restrictions from aggregate Site No. 1 to the fishing access site below the dam. Displaced recreational opportunities would be redistributed to other areas of the state park, however, because of anticipated reductions in overall visitation to the state park during construction, this redistribution would not result in significant over-crowding of the other areas at Rattlesnake, Campers, PeeWee, and Sand Points. Off-road travel on the exposed reservoir margin after drawdown could provide temporary access to the shoreline between Sand Point and the dam.

Impacts of alternatives 1 and 2 on access to the State Park would be moderate to major in the short term and negligible in the long term.

4.16.1.2 Tongue River State Park

During typical years, new reservoir water levels would cause only a slight change in recreational opportunities at Tongue River State Park. However, the changes that would occur are mostly related to the size and nature of the areas available for camping (see Recreation Experience section below for discussion of impacts to the nature of camping experience). Increased water levels would inundate the flats, thereby eliminating those areas as effective campsites. However, because of the relocation of the county road, the acreages available for "rustic" camping would be similar to those currently experienced at the reservoir (see **Table 4-11**). Total area available would increase at Campers and PeeWee points by 5 and 27 acres, respectively. Roughly 13 and 40 acres would be lost at Rattlesnake and Sand Points, respectively, after the new water level was established. Neck Bay, Cormorant Bay and the North Shore areas would lose approximately 5 acres. The recreation mitigation and enhancement plans call for a restructuring of the state park to include more developed access to camping areas while keeping the rustic nature of the opportunity intact (proposed mitigations to the state park are projected to cost between $350,000 to $450,000 and enhancements $1,000,000 to $1,250,000).

TABLE 4-11
Change in Acreage Available for Camping

Camping Opportunity	Acres From Proposed Water Elevation To New Road	Acres From Normal Elevation (3,2420 Feet) To Old Road	Project-related Change in Available Camping Acres
Rattlesnake Point	77	90	-13
Campers Point	86	81	+5
PeeWee Point	71	44	+27
Sand Point	69	109	-40
Neck Bay	39	39	0
North Shore	20	25	-5
Total	**362**	**388**	**-26**

Source: Figures developed by MME Corp. 1994

Recreational facilities at the state park, such as the sand beach at Sand Point, would be replaced, and some relocated such as the boat ramps and picnic shelters at Campers Point, resulting in no net loss of opportunity (see **Figure 2-12**). In other cases, facilities such as the restrooms, campsites, and access for boats would be improved, and others added, such as a fish cleaning station at Campers Point.

Overall, any long-term impacts that may occur would be mitigated. The proposed mitigation and enhancement plans would benefit state park users in the long run. Impacts of new higher water levels under alternatives 1 and 2 on the state park would be negligible to minor in the long term.

4.16.1.3 Downstream Floating and Fishing

Short-term impacts to downstream floating and fishing include access restrictions discussed earlier in this section. In general, downstream floating and fishing would be impacted in the short-term during installation of the bypass if this occurred under Alternative 2. Postconstruction reservoir operations would have a positive impact on downstream floating and fishing opportunities as more consistent flows would be released from the dam (**see Appendix E**).

Impacts of alternatives 1 and 2 on downstream floating and fishing opportunities would be negligible to minor in the short term and long terms.

4.16.1.4 Recreational Experience

During construction, the recreational experience would be impacted by access restrictions, fluctuating water levels, construction-related noise and dust, and temporary use restrictions at the fishing access site and state park facilities.

The recreational experience would be impacted by new water levels as the new acreage made available for camping would lack the qualities of those lost. Increased water levels would inundate the flats, thereby eliminating those areas as effective campsites and forcing the recreationists onto steeper slopes. In addition, the woody vegetational zone that is used extensively for shade, wind relief, and privacy by recreationists, would be reduced from an average width of 8 feet to an average width of 2 feet because of the steep nature of the "new" shoreline (J. Little, pers. comm., February 11, 1994).

Fluctuating water levels and changes in fish populations and distribution during construction could impact overall boating and fishing experiences of visitors to the reservoir. Noise and dust from construction related activities could impact the recreational experience of visitors to the state park near aggregate Site No. 1 and those recreating near the dam construction area. Losing the use of the fishing access site and campground below the dam would eliminate the opportunity to experience the use of that area in the short-term. Impacts of alternatives 1 and 2 on recreational experiences would be moderate to major in the short term and negligible to minor in the long term.

4.16.1.5 Boating Hazards and Navigational Safety

Construction activities would cause the water levels to fluctuate between elevation 3,390.5 and 3,409 and 3,416 feet under alternatives 1 and 2, respectively. Although construction schedules, drawdown schedules, and refilling elevations differ between the action alternatives, the character of the impacts would remain the same. The drawdown schedule would expose navigational hazards, make shoreline access and use an inconvenience, disturb camping and picnicking activities, and temporarily interrupt the use of existing docks and boat ramps.

Prior to spring runoff in 1997, a coffer dam would be constructed after which the reservoir could be allowed to store water from spring runoff. Between September and October of that year, water levels would drop to elevation 3,390.5 feet -- effectively limiting boating opportunities for up to 2 months during construction of the cellular coffer dam. Spring runoff in 1998 would be stored up to reservoir elevation 3,409 feet under Alternative 1 or 3,416 feet under Alternative 2 during which boating activities could resume.

Temporarily maintaining the reservoir at low elevations during construction would cause some underwater benches to be exposed or nearly exposed, much like those that appear at Rattlesnake, Campers, and PeeWee points during current low water levels. Submergent benches could expose hazards to boaters in the form of sandbars, submerged trees, and sunken debris. Hazards would not be marked and fluctuating water levels would make it difficult to identify all obstructions. However, notice of hazards related to reservoir drawdowns would be posted at the state park and especially at the boat ramp.

Areas of shallow water, submerged hazards, and poor substrate for anchoring would make use of, and access to, the shoreline an inconvenience. Camping and picnicking facilities on shore could be reached by boat, although latrines, picnic shelters, and developed fire rings would be further up the shoreline. Park managers would continue to allow boaters to use the shore for various recreational activities.

Existing boat ramps and possibly the private boat slips could be used during the construction drawdown period as long as the water levels remained above elevation 3,400 feet. Below this point, the concrete boat ramp would not reach the water's edge. Boats would be required to launch directly from shore, causing potential damage to boats, trailers, and towing rigs. Docking would need to be directly on shore, potentially damaging boats, and causing safety concerns for passengers.

During construction of coffer dams in the spring, and the 2-month drawdown period in the fall, an estimated 35,000 boating hours would be lost. This figure represents a loss of opportunity for an estimated 250 to 600 boats during the period.

Upon completion of the project, subsurface obstacles in newly flooded areas could pose navigational hazards for boaters near shore. Impacts of alternatives 1 and 2 on boating opportunities and navigational safety would be moderate in the short term and minor to moderate in the long term.

4.16.2 Effects From Alternative 3

Long-term recreational impacts under Alternative 3 include those resulting from drawdown water levels and the potential for total loss of recreational opportunities in the case of dam failure. The drawdown water levels currently experienced on the reservoir would continue under Alternative 3. Boating opportunities would be uncertain and often risky as nearly exposed sandbars, submerged trees, and sunken debris could pose hazards to boaters.

The drawdown water level would continue to provide intermittent beaches for camping and off-road recreation. Large expanses of exposed beaches would continue the available room for recreational activities. Existing facilities listed in Chapter 3 would remain unchanged for the most part, including the marina at Campers Point.

Long-term impacts to recreation could occur if the dam was not repaired and ultimately failed. Boating, fishing, and other recreational uses would be eliminated. Day use and terrestrial-based recreation could continue without the benefit of the reservoir experience. Impacts of the no-action alternative on recreational use of the State Park would be minor to moderate in the short and long terms with the potential to become major and significant in the event of dam failure.

4.17 LAND USE AND OWNERSHIP

4.17.1 Effects Common to the Action Alternatives

Land use impacts would be similar under both action alternatives. About 400 acres would be inundated by the raised water elevation in the reservoir. Between 1,000 and 4,600 acres of private land adjacent to the reservoir could be acquired for reservoir operation and, secondarily for riparian and wildlife mitigation. If easements were not negotiated, this could result in a shift in landownership **(see Figure 3-8)** (from private to public), and have minor secondary effects on agriculture and fiscal conditions. In addition, DNRC would have to negotiate for flood easements over private and public lands other than DNRC's, to elevation 3,440 feet.

A small amount of crop and grazing land would be affected by the change in ownership. Since the acreage affected is less than 1.0 percent of total land in the county, and because DNRC could lease the land for agricultural purposes in the future, this impact would be negligible.

Livestock exclusion fencing is proposed as a wildlife habitat mitigation on most DNRC lands as part of the project. Although this would curtail trespass livestock use of DNRC lands, causing some loss of grazing to local landowners, it would provide a beneficial impact to recreationists and wildlife in the area. Impacts of action alternatives on land use and ownership would be minor in both the short and long terms.

4.17.2 Effects From Alternative 3

Under the no-action alternative, landownership adjacent to the reservoir would probably remain in the same general balance of private and public ownership. Livestock trespass on unfenced public lands would be perpetuated, resulting in continued minor inconvenience for recreationists and deterioration of wildlife habitat. Impacts of the no-action alternative on land use and ownership would be negligible in both the short and long terms.

4.17.3 Cumulative Effects

If the Tongue River Railroad was built, it is assumed that agricultural land would be acquired for right-of-way. This would result in a cumulative loss of agricultural land in the Tongue River Basin.

4.18 CULTURAL RESOURCES

4.18.1 Effects Common to the Action Alternatives

Six known Euro-American and 11 known Indian cultural resources would be affected by the proposed raising of the water level and associated construction activities **(see Table 4-12)**. Two of the 11 Indian sites have been recommended as eligible to the National Register of Historic Places (NRHP). Three of the six Euro-American sites have been recommended as eligible to the NRHP. These recommendations are currently under review by USBR and the Montana State Historical Preservation Office (SHPO).

Site 24BH591, the ring site that may be associated with Two Moons, would not be directly affected by the proposed action. The bison kill (site 24BH2613) would be further inundated. This site has been recommended as eligible to the NRHP due to its traditional cultural significance (Criterion A)[2] and its informational value (Criterion D). Mitigation of effects to site 24BH2613 would be determined by USBR in consultation with the appropriate parties. The Northern Cheyenne and Crow have specifically requested that they be included in any discussion of treatment of site 24BH2613 (Peterson, Ibanez, and Brownell 1995).

Site 24BH2317, a stone ring site with a heavy concentration of a relatively rare lithic type, has been recommended as eligible to the NRHP for its informational value (Criterion D). This site would be partially inundated and would see increasing disturbance by recreational users of the reservoir. Mitigation of effects to site 24BH2317 would be determined by USBR in consultation with the appropriate parties. The Northern Cheyenne and Crow have specifically requested that they be included in any discussion of treatment of site 24BH2317 (Peterson, Ibanez, and Brownell 1995).

The Lee Homestead (site 24BH2349) would be affected by the proposed dam construction. It was listed on the NRHP in 1981. Two other historic sites that would be affected by the project have been recommended as eligible to he NRHP. One is a farmstead (site 24BH2271) and the other is the Tongue River Dam (site 24BH2589).

Mitigation of effects to historic sites would be determined by USBR in consultation with the appropriate parties. Possible treatment strategies include additional photography, historical research as well as data recovery at the Shreve homestead. Additional research may be done to determine if there is a National Register District based on locally distinctive stone architecture such as that seen at sites 24BH2349, 24BH2271, and 24BH608.

Indirect effects of the project on cultural resources would result if increased recreational development of the area leads to vandalism of the sites. Impacts of action alternatives on cultural resources would be moderate in the short and long terms.

---

[2] According to CFR, Title 36, Part 60, an historic property can be nominated to the NRHP if it is associated with events that have made a significant contribution to the broad patterns of our history (Criterion A); or is associated with the lives of persons significant in our past (Criterion B); or it embodies the distinctive characteristics of a type, period, or method of construction, or it represents the work of a master, or it possesses high artistic values, or it represents a significant and distinguishable entity whose components may lack individual distinction (Criterion C); or it has yielded, or may be likely to yield, information important in prehistory or history (Criterion D).

TABLE 4-12
Cultural Resources Affected by the Proposed Raise in Water Levels and Associated Construction Activities*

SITE #	TYPE	LAND OWNER	IMPACT	NR RECOMMENDATION
Historic Sites				
24BH0604	Farmstead	DNRC	Inundation	IE
24BH2271	Farmstead	DNRC	Inundation	E - A, C, D
24BH2349	Farmstead	DNRC	Dam	Listed
24BH2589	Dam	DNRC	Dam	E - A
24BH2616	Farmstead	DNRC	Inundation	IE
24BH2670	Railroad Grade	DNRC	Inundation	IE
Prehistoric Sites				
24BH0605	Lithic Scatter	Decker Coal & DNRC	Inundation	IE
24BH0606	Lithic Scatter	DNRC	Inundation	IE
24BH1064	Lithic Scatter	Private	Inundation	IE
24BH1979	Lithic Scatter	DNRC	Inundation	IE
24BH2316	Lithic Scatter	DNRC	Inundation	IE
24BH2317	Stone Circle	Decker Coal & DNRC	Inundation	E - D
24BH2585	Lithic Scatter	DNRC	Inundation	IE
24BH2592	Lithic Scatter	Private	Road	IE
24BH2605	Lithic Scatter	Private	Secondary	UNK
24BH2610	Lithic Procurement	DNRC	Inundation	IE
24BH2613	Bone Processing	Private	Inundation	E - A, D

KEY:
NR Recommendation = National Register Eligibility Recommendation
E = Recommended Eligible for nomination to the NR
A = Recommended Eligible under Criterion A
B = Recommended Eligible under Criterion B
C = Recommended Eligible under Criterion C
D = Recommended Eligible under Criterion D
IE = Recommended Ineligible
UNK = No Eligibility Recommendation
* as defined by DNRC (1992, 1994)

Source: Estimates prepared by Morrison-Maierle/CSSA 1994.

4.18.2 Effects From Alternative 3

If Tongue River Dam failed, there would be a significant but unknown number of effects to cultural resources. The NRHP-listed Lee Homestead would lose its contextual setting. The dam, recommended for listing on the NRHP, would be significantly altered. An unknown number of sites downstream, north of the dam, would be affected by water-caused erosion due to nonregulated flows of the Tongue River. Upstream, a number of historic and prehistoric sites (currently under water) would be exposed. The draining of the reservoir would expose mud flats to wind erosion, leading to site compaction and loss of stratigraphic integrity (collapsing of soil layers). The number of sites that would be affected is unknown because no inventory was done prior to flooding of the original reservoir.

Impacts of the no-action alternative on cultural resources would be negligible in the short and long terms with potential to become major and significant under dam failure.

4.19 NOISE

4.19.1 Effects Common to the Action Alternatives

Applicable noise regulations and guidelines provide a basis for evaluating project-related noise impacts. For example, for federally funded highway projects, traffic noise impacts are considered to occur when predicted hourly equivalent sound levels (Leq[h]) approach or exceed noise abatement criteria as established by the Federal Highway Administration (FHWA) or substantially exceed existing noise levels (23 CFR 772). Although "substantially exceed" is not defined, FHWA considers an increase of 10 A-weighted decibels (dBA) or greater to be a substantial increase and thus an impact. The FHWA noise abatement criterion for residences, parks, schools, churches, and similar areas is 67 dBA. FHWA considers a noise impact to occur if predicted Leq(h) noise levels approach within 1 dBA of noise abatement criteria.

4.19.1.1 Roads and Highways

Leq(h) traffic noise levels during construction of the proposed project at several locations on area highways have been estimated and are shown on **Table 4-13**. Predicted noise emissions from free-flowing traffic at constant speeds depend on the number of automobiles and trucks per hour, vehicular speed, and reference noise emission levels of an individual vehicle. Noises from the peak periods during construction of relocated portions of County Road No. 380 would be transitory along the right-of-way, ranging from 65 to 85 dBA at 300 feet.

Noise impacts would occur along Secondary Highway 314 (S-314) in the community of Decker during construction. Based on FHWA guidelines, noise abatement would not be necessary at the U.S. Post Office or any other buildings because they are more than 50 feet from the roadway and therefore would experience noise levels less than the 67 dBA FHWA threshold.

TABLE 4-13
Noise Levels (in dBA) on Roadways During Construction

ROADWAY	LOCATION	DISTANCE FROM CENTERLINE (feet)			
		50	100	150	200
S-314	Decker	67(65)[1]	64(62)	62(60)	61(59)
S-314	South of Road 380	63(59)	60(56)	58(54)	57(53)
Road 380	Between S-314 & Site 1	57(47)	54(44)	53(42)	51(41)
Road 380	Between Site 1 & Dam	59(45)	56(42)	54(41)	53(39)

1) Existing noise levels without construction are shown in parentheses.

Noise impacts would also occur along County Road No. 380 from S-314 to the dam site because, for distances at least 200 feet from the roadway, existing noise levels would be exceeded by 10 dBA or more. These impacts would occur for a period of 1 to 2 months during the late summer/fall of 1996 during the heaviest period of transportation of most construction materials. During most of the remainder of the construction project, noise levels are expected to be less and would exceed existing levels by less than 10 dBA. Impacts of action alternatives on road and highway noise would be minor in the short term and negligible in the long term.

4.19.1.2 Construction Staging Area

During major construction operations at the dam site, noise levels are expected to range from 75 to 95 dBA and should drop to 55 to 75 dBA 1,000 feet from the site and 45 to 65 dBA 0.5 mile from the site. There are no residences, campgrounds or other sensitive noise receptors in the area that would be affected during construction -- the fishing access site north of the dam would be closed during construction since it would be used as a staging area. Isolated boaters, fishermen, hikers, campers, and other recreationists within 0.5 mile of the construction site may be adversely impacted during construction. These impacts would be of short duration during one summer.

After completion of the construction project, noise levels at the dam site would return to existing levels. Since noise impacts at and near the construction site would be short term only and there would be no sensitive noise receptors in the area other than dispersed recreationists, no mitigation measures are proposed. Impacts of action alternatives on construction staging area noise would be minor in the short term and negligible in the long term.

4.19.1.3 Tongue River State Park

Noise impacts would occur along County Road No. 380 from S-314 to the dam site from transportation of construction materials. Tongue River State Park is adjacent to this reach of the road. At distances of 200 feet from the roadway, existing noise levels would increase by 10 dBA or more. These impacts would occur for a 1-to-2-month period during late summer/fall of 1996. During most of the remainder

of construction, noise levels would be less and would raise existing levels by less than 10 dBA. Impacts of action alternatives on Tongue River State Park noise would be minor in the short term and negligible in the long term.

4.19.1.4 Sheridan, Wyoming

In Sheridan, a three-to-four block residential area would experience noise level increases due to increased truck traffic if materials were hauled to the rail yard and then trucked to the project site. It is estimated that in this area noise levels would increase by approximately 7 dBA and would be 62 to 67 dBA. If this rail option were used, noise impacts of action alternatives on Sheridan, Wyoming, would be moderate in the short term and negligible in the long term.

4.19.1.5 Decker, Montana

Table 4-11 shows noise levels that would occur at different distances from the centerline of Secondary Highway 314 in the community of Decker. Please note that noise levels are currently relatively high in Decker due to mining activities and related trucking. Based on FHWA guidelines, noise abatement criteria would not be necessary at the U.S. Post Office or any other buildings because they are greater than 50 feet from the roadway. Noise impacts of action alternatives on Decker, Montana, would be minor in the short term and negligible in the long term.

4.19.2 Effects From Alternative 3

Under the no-action alternative, noise in the study area would remain at current levels.

4.20 VISUAL RESOURCES

4.20.1 Effects Common to the Action Alternatives

Short-term direct impacts would occur to visual resources in general, and indirectly to recreationists at Tongue River State Park, from changes in appearance of the dam and spillway, county road relocation and cuts-and-fills, placement of riprap or vegetative embankment protection, construction staging area disturbance, and elevation of the shoreline.

These moderate short-term impacts would be most noticeable to recreationists who would perceive not only changes in the status quo, but who would also be impacted by relocation of recreation facilities and temporary loss of vegetation from new water elevations.

Long-term impacts to visual resources would result from the same sources but would be negligible as the shoreline, riparian vegetation, and new park facilities were re-established. In the long term, views from the water and the shoreline would return to near-existing visual conditions.

4.20.2 Effects Unique to Alternative 1

Under Alternative 1, the labyrinth spillway would look similar to the existing spillway except for the zigzag crest. Impacts on visual resources from the labyrinth weir appearance would be negligible in the short and long terms.

4.20.3 Effects Unique to Alternative 2

Under Alternative 2, the primary concrete chute spillway would look similar to the existing spillway. The RCC secondary and emergency spillways would modify the profile of the existing (historic) dam crest (it would be lowered by 13 feet) and the downstream dam face and toe would be capped by RCC. Impacts on visual resources from the primary spillway would be negligible in the short and long terms. Impacts on visual resources from the RCC secondary and emergency spillway profile would be minor in the short and long terms.

4.20.4 Effects From Alternative 3

Under the no-action alternative, visual resources would remain much the same as existing conditions unless a dam failure occurred. Under that scenario, significant visual impacts would occur from large increases in exposed shoreline, loss of the reservoir pool, and dramatic erosion downstream of the reservoir in the Tongue River Valley. The dam structure itself would be dramatically altered, and could become a visual attraction if breached. Impacts on visual resources from the no-action alternative would be negligible in the short and long terms with the potential to become major and significant under dam failure.

4.21 PROJECT EFFECTS THAT CANNOT BE AVOIDED

4.21.1 Air Quality

There would be minor and short-term impacts to air quality from construction activities, and from wind erosion of exposed mud flats during and after construction.

4.21.2 Soils

Potential erosion of 14 miles of shoreline would be unavoidable.

4.21.3 Hydrology

Increases in peak flood discharges under Alternative 1 would be unavoidable.

4.21.4 Wetlands

Loss of narrow bands of wetland on portions of reservoir shoreline would be unavoidable with proposed reservoir operations. These wetlands are pioneer plant communities, dominated by one or two species adapted to growth in disturbed habitats. In general, these wetlands have relatively low wildlife values

because of low vegetative species diversity and limited development of structural habitat components (e.g., overstory canopy of trees, lack of diverse understory, and lack of fallen and standing dead trees and other woody material).

4.21.5 Aquatics/Fisheries

If a bypass in the low level outlet works was used under Alternative 2, the one-time downstream release of 25 cfs (accomplished by pumping) for up to 2 weeks would dry out a portion of the river bed causing mortality of a portion of the macroinvertebrate population. This impact could be avoided by installation of an auxiliary outlet during construction.

4.21.6 Wildlife

Unavoidable indirect impacts would occur to a number of terrestrial and avian species due to changes in wildlife habitat and nest sites.

4.21.7 Vegetation

Plant communities along portions of the reservoir shoreline that would be lost due to inundation. Small amounts of upland vegetation would also be lost from wave action and subsequent shoreline erosion at the upper elevations of reservoir pool.

4.21.8 Biodiversity

Plant communities along portions of the reservoir margin would be unavoidably lost but this loss would have negligible effects on local and regional biological diversity. Plant species comprising communities that would be lost are abundant and present at many sites within and near the project area. Loss of wildlife habitat affected by the project would have negligible impacts on local or regional wildlife populations.

4.21.9 Economic Conditions

Fiscal impacts to federal and state agencies responsible for Settlement Act payments, mitigation, and dam repair would be unavoidable. Short-term losses of revenue from decreases in camping and fishing would occur to DFWP and local concessionaires.

4.21.10 Transportation

Access to the east side of the reservoir would be temporarily restricted as would access near the construction staging area. Traffic volumes in the vicinity of the construction staging area would increase substantially during construction.

4.21.11 Recreation

Restriction and temporary disruption of certain activities, such as boat launching, would occur both on the reservoir and downstream such as at the fishing access site.

4.21.12 Land Use and Ownership

A minor amount of agricultural land would be lost to agricultural production from inundation. About 75 acres of land would be committed to road and road right-of-way use for relocation and construction of County Road No. 380 and East Shore Road.

4.21.13 Cultural Resources

The inundation of sites 24BH2317 (ring site), 24BH2613 (bison kill), and 24BH2271 (farmstead) cannot be avoided if the reservoir water levels are raised 4 feet. Effects to the Lee Homestead and the dam likewise cannot be avoided.

4.21.14 Noise

Noise impacts would occur in areas within 200 feet of County Road No. 380 and within 0.5 mile of the construction site during a 1-to-2-month period in the late summer/fall of 1996. High truck volumes would occur due to hauling of materials to the dam site. When construction was complete, noise levels would return to existing levels.

4.21.15 Visual Resources

If the RCC alternative was selected, the crest of the existing dam would be lowered by 13 feet, and the downstream face capped by RCC. Temporary visual impacts around the reservoir margin from loss of vegetation due to inundation would be unavoidable.

4.22 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

4.22.1 Geology

Aggregate used for project alternatives would be irreversibly and irretrievably committed to the beneficial use of dam repair and road improvements.

4.22.2 Soils

Relocation of the State Park, shoreline erosion, and road relocations and associated facilities would require the commitment of land and underlying soils to other uses for the life of the project. Soils underlying the land would be irreversibly committed and in some cases irretrievably lost to these uses.

4.22.3 Wetlands

Inundation and loss of wetlands with the action alternatives would be an irreversible, minor commitment of site-specific resources. Wetland enhancement and mitigation would offset this loss on a regional basis.

4.22.4 Aquatics/Fisheries

About 1 mile of river upstream of the reservoir would be converted to reservoir pool for the life of the project.

4.22.5 Wildlife

As discussed in the vegetation section, long-term changes in vegetation would result in related responses from wildlife (e.g., as habitat increased or decreased, animal use would increase or decrease). However, conversion of upland grasslands and shrublands to long-lived, pioneer riparian plant communities would contribute to a greater diversity of terrestrial wildlife in the area than would be present otherwise. Such conditions would exist while the reservoir was in place.

4.22.6 Vegetation

The loss of upland grasslands and shrublands due to road and park facility construction would be irreversible. Loss of the narrow band of riparian vegetation around the reservoir that would be inundated with the action alternatives would be a minor but irreversible commitment of resources; however, failure or removal of the dam would allow riparian plant communities to gradually revert back to upland grass and shrub communities. Eventually, (probably 50-100 years after lowering of water levels) plant communities similar in productivity and species diversity to existing native upland communities would re-establish.

Conversion of riparian plant communities to upland communities with removal or failure of the dam would likely be impeded if noxious weeds became established during the succession from wet to dry conditions. Establishment of noxious weeds could prevent a diverse and productive cover of vegetation on previously flooded shoreline for an unknown period of time. If noxious weeds were to become established, in the absence of eradication or control, they could form long-lived communities that could persist for hundreds of years. These long-lived disturbance-caused communities may represent an irretrievable commitment of vegetation resources.

4.22.7 Biodiversity

Biological diversity would be incrementally and irretrievably lost with construction of roads and campground facilities. Wildlife species would experience habitat losses from direct removal of plant communities and indirect habitat loss from displacement from high levels of human activity associated with recreation.

4.22.8 Cultural Resources

In terms of cultural resources, the only known bison kill (site 24BH2613) from the project area would be destroyed. As noted, the informational value of the site can be retrieved by data recovery through excavation. The traditional cultural values associated with the site probably can only be partially mitigated. To the extent that removal of site materials, caused either by water action or archaeological excavation, limits the Northern Cheyenne's ability to renew their cultural ties with the area, criterion A (contribution to broad pattern of history) values would be irretrievably and irreversibly lost. This may be mitigated by the Northern

Cheyenne's continuing access to the bluff above the site which would not be inundated and, for some, by the historical information retrieved from the site.

4.22.9 Visual Resources

The project would irretrievably commit the appearance of the dam to something different than it is today; more noticeably under Alternative 2 than Alternative 1 because of the lowered dam crest and RCC cap on the downstream face.

4.23 SHORT-TERM USES VERSUS LONG-TERM PRODUCTIVITY

4.23.1 Wetlands

The action alternatives would result in the local, long-term loss of wetlands that have developed on the reservoir shoreline. Lost or degraded functions and values of these wetlands would be compensated by enhancement of existing poor-quality wetlands and construction of new wetlands; therefore, there would be no net loss of wetland productivity on a regional basis.

Dam failure would result in the long-term loss of wetlands that have become established on the reservoir margin. This loss would be temporary because new wetlands would form along the stream channel that would flow through the drained reservoir.

4.23.2 Wildlife

Impacts to terrestrial wildlife would be tied closely to the vegetational changes occurring as a result of the increased reservoir water levels. Species dependent upon viable riparian habitat would be displaced in the short term. Birds would have more options in seeking unoccupied habitats. Long-term impacts would be negligible in that similar habitats to those present can be expected to develop, and in turn, be occupied by species of animals similar to those currently in the area.

4.23.3 Vegetation

Implementation of alternatives 1 and 2 would kill inundated riparian plant communities and convert small acreages of upland plant communities on the reservoir margins to pioneer riparian communities. Pioneer communities are generally low in species and habitat diversity. Riparian plant communities, that would become established after implementation of the proposed action, would produce more biomass than would existing upland communities that they replaced. However, they would have lower levels of species diversity with relatively little understory.

Currently, most upland sites have high grazing potential for livestock and provide habitat for wildlife adapted to shrub/grassland habitats. Conversion to riparian vegetation would reduce grazing values for livestock and alter habitat values for wildlife. The conversion of upland to pioneer, riparian plant communities would elicit long-term (i.e., for the life of the dam) changes in productivity, species diversity, and potential use for grazing and wildlife habitat.

Loss of native upland plant communities with the action alternatives (e.g, road and park facility construction) would be a long-term loss of this area for livestock and wildlife use.

4.23.4 Biodiversity

Long-term, minor losses in vegetative productivity would result from construction of new roads and campground facilities. Portions of native plant communities would be converted to non-vegetated land uses. Disturbance from construction activities would increase potential for establishment and proliferation of noxious weeds; a long-term loss in productivity of livestock forage and wildlife habitat in the absence of control measures.

Dam failure would result in loss of reservoir contents and fish populations. Because most of the fish species in the reservoir also are present in the Tongue River, there would be negligible impact on species diversity although total fish numbers and fish production would decline. Loss of high levels of fish production in the Tongue River Reservoir with dam failure would be a long-term loss.

4.24 FULFILLMENT OF SETTLEMENT ACT WATER RIGHTS IN THE TONGUE RIVER BASIN

Impacts of Settlement Act water rights are analyzed in general because the timing, extent, and nature of the Tribal use of water is unknown at this time. In order to make an assessment of the nature and breadth of impacts from the allocation of Settlement Act water rights, high- and low-use scenarios have been developed. High use assumes that the Tribe would use up to 20,000 acre-feet of stored water within 1 calendar year or irrigation season. Low use would assume that up to 20,000 acre-feet would be left in the reservoir or used to a small degree to supplement low flows in the Tongue River below the dam. These two scenarios bracket many other possible amounts and times of use.

The Tribe has water rights for 40,000 acre-feet of water in the Tongue River Basin: 7,500 acre-feet of existing stored water in the reservoir, 12,500 acre-feet of direct flow, and up to 20,000 acre-feet settled on under the Settlement Act that is a combination of stored and exchange water (return flows from irrigation). It is the impact from the use of water allocated under the Settlement Act (up to 20,000 acre-feet) on which this section focuses.

High use would result in greater reservoir fluctuations, contributing to direct physical impacts to the reservoir and its shoreline. Secondary impacts would include effects on recreation similar to those described in this EIS, effects on waterfowl foraging and nesting habitat from lower water levels, effects on vegetation from a less stable water supply to plants around the reservoir edge, possible effects on air quality from dust generated by winds blowing over exposed shoreline, and lower instream flows in the Tongue River downstream of the reservoir.

The most likely use of the Tribe's water right would include use of water for irrigation within the basin, sale to other irrigators in the basin, and lease of water to the state of Montana to supplement instream flows. Development or sale of water for irrigation would likely divert the greatest amount of water because agricultural return flows would be credited to the Tribe as exchange water. The concept of exchange water was used to provide the Tribe with the largest possible water supply. This concept would allow any return

flows from Tribal irrigation diversion to be available to other users on the Tongue River downstream. This is possible because the irrigable lands of the Tribe lie upstream of the last major diversion on the river (T&Y). Returns that enter the river above this diversion can replace direct flow or contract water of existing users. Therefore, this exchange of water frees up additional direct flow and contract water that can be used by the Tribe in addition to their basic contract amount.

When stored water shortages were experienced, they would be shared proportionately by all water rights holders entitled to reservoir water. This could result in less irrigation and related agricultural production in dry years.

There would be only negligible cumulative effects from other reasonably foreseeable projects. However, the cumulative effects of the high-use scenario with other water use in the basin (full Wyoming development) could have major and significant impacts. Heavy irrigation use during dry years could produce dramatic fluctuations in reservoir and river-flow levels. The reservoir could be drawn down in summer to supply the Tribe's right and then filled to capacity (if flows allowed) in fall, winter, and spring in anticipation of the next year's use.

A water model was developed to predict the future reservoir operation and releases to the river (Larry Dolan, Department of Natural Resources and Construction, in a memo to Greg Ames, December 29, 1994). The historic and proposed reservoir elevations and storage through the course of a year are shown on **figures 4-4 and 4-5**. Two proposed conditions in addition to the historic condition are shown; the first is for no further development of Wyoming's Yellowstone River Compact water (existing condition) and the second is for full development of Wyoming's Yellowstone River Compact water. Historic conditions should be compared to the proposed condition with no Wyoming development to isolate the differences attributed to the project. The comparison of historic and proposed conditions with no further development of Wyoming water indicates that the reservoir would be at higher elevations and storage during all months of the year. Reservoir elevations and storage with full development of Wyoming water are substantially lower than with no development of Wyoming water but are still higher than historic conditions. The historic reservoir elevations and storage have been influenced by reservoir operation criteria which have reduced reservoir storage due to the condition of the spillway.

Historic and proposed releases from the project over the course of a year are shown on **Figure 4-8. Figure 4-9** shows the corresponding typical depth of flow in the river. Again, historic conditions should be compared with existing Wyoming development to isolate the impact of the project. The comparison of historic and proposed conditions with no further development of Wyoming water indicates that the releases and stream depths would be similar during all months of the year. Releases would be slightly higher in June during normal years due to the filling of the reservoir and use of the spillway. Releases with full development of Wyoming water are substantially lower during the months of May and June.

4.25 IMPLEMENTATION OF FISH AND WILDLIFE HABITAT ENHANCEMENT FEATURES

Enhancement features discussed in this section were presented in Chapter 2, Fish and Wildlife Habitat Enhancement Features, and **Appendix C**. These features would be implemented singularly, or as groups, as the program was carried out.

A recap of potential enhancement features is provided on **Table 4-14**. Resources that are likely to experience effects as a result of implementing a feature are displayed in **Table 4-15**. Individual effects of implementation will also serve as the basis for screening features during subsequent planning stages. The identification of an adverse impact may require modification or elimination of a feature from further consideration. Impacts are discussed only in general terms because the timing, location, and extent of enhancement activities are not yet known. Environmental compliance would be conducted, however, as enhancement features were implemented.

4.25.1 Soils

Soils present both limitations and suitability concerns for implementing enhancement features. Physical soil characteristics and topography determine the suitability of a site for an engineering feature or revegetation success. Characteristics that classify soils/site as prime or unique agricultural land or land of statewide importance can serve as constraints to development regardless of physical suitability. Enhancement features could benefit soils via erosion control measures, and impact soils from exposure, use, and disturbance associated with structural measures. Irreversible commitment of soils to enhancement features also would result.

Sediment control would require detailed soils and watershed yield analyses as well as design considerations for visual, cultural resources, hydrology, and additional economic impacts. Sediment control usually includes a watershed/soil conservation plan that would involve indirect impacts to social conditions and land use and ownership.

4.25.2 Hydrology

When water and water source development is a component of an enhancement feature, the design process must include an evaluation of water quantity available for use as well as an analysis of the impacts of the proposed use on surface and ground water regimes, quality, and competing uses. A water-use permit would have to be obtained from DNRC for enhancement projects that would use surface or ground water. Impoundments constructed for water source development or sediment trapping may affect surface water, local ground water, and the likelihood of success in accomplishing enhancement objectives. Since the ability of water to carry sediment is based on hydraulic characteristics, eliminating a sediment source may cause the river to scour an area to obtain its sediment load. Enhancement features could impact water quantity and quality if they include water source development, sediment traps and erosion control, evaporation of ponded water, and accelerated transpiration by water-loving vegetation.

4.25.3 Wetlands

Enhancement measures may increase biological diversity of plant communities by creating wetlands on sites that currently are predominated by upland species (hayfields, pasture, and previously disturbed sites). Replacement of upland plant non-native species by wetland plant species would increase species diversity locally but would have negligible effects on species diversity regionally. Typically, created wetlands are relatively low in species diversity and are comprised of pioneer plant species that are relatively common regionally. These newly created wetlands would likely be populated by wildlife species such as red-winged

TABLE 4-14
Potential Enhancement Features

1. Acquire lands of high habitat value through purchase or easement to enhance or protect those values.

2. Develop and enhance existing wetland sites.

3. Develop stock pond/small wetlands.

4. Construct wetlands.

5. Enhance aquatic habitat.

6. Enhance riparian habitat.

7. Enhance upland habitat by providing water, shelter belts, dense nesting cover, food plots, and sediment control.

8. Enhance instream flows by: 1) a water rights acquisition program; 2) monitoring and enforcement of diversion; 3) a streamflow gauging program.

9. Provide fish passage around diversion dams.

10. Screen inlet structures at diversions.

11. Initiate livestock management and exclusion systems.

12. Enhance the Tongue River Reservoir perimeter.

13. Install bird nesting structures along the Tongue River Corridor and Reservoir Shoreline.

14. Remove trash and car bodies from selected sites.

15. Develop weed control programs.

16. Develop cooperative programs with private landowners and agencies and develop habitat conservation education program as part of an overall ecosystem management planning activity.

17. Provide short grass/native prairie ecosystem management/enhancement on the Northern Cheyenne Reservation including prairie dog re-establishment in plague-affected areas on the reservation, and a bison restoration program.

TABLE 4-15
Resources That Could be Affected Adversely or Beneficially by Implementation of Enhancement Features

	Soils	Hydrology	Wetlands	Aquatics/ Fisheries	Wildlife	Vegetation	Biodiversity	Social Conditions	Economic Conditions	Recreation	Land Use & Ownership	Cultural Resources	Visual Resources
Acquire lands	x	x	x		x	x	x	x	x	x	x	x	
Develop & enhance wetlands	x	x	x	x	x	x	x		x	x	x	x	x
Develop stock ponds/wetlands	x	x	x	x	x	x	x		x			x	
Construct wetlands	x	x	x	x	x	x	x		x			x	
Enhance aquatic habitat		x		x		x	x		x	x	x	x	
Enhance riparian habitat	x	x	x	x	x	x	x	x	x	x	x	x	x
Enhance upland habitat	x	x			x	x	x	x	x	x		x	x
Enhance streamflows		x		x			x		x	x	x		
Provide fish passage		x		x			x	x	x			x	x
Screen inlet structures				x			x		x			x	
Initiate livestock management and exclusion systems	x	x	x	x	x	x	x		x		x	x	x
Enhance Tongue River perimeter	x		x		x	x	x		x			x	x
Install bird nesting	x	x			x				x			x	
Remove trash & car bodies						x			x			x	x
Weed control	x				x	x	x		x				
Co-op program & education of land-owners								x	x				
Native prairie mitigation & enhancement	x	x	x		x	x	x	x	x	x		x	

Source: Developed by MME Corp. 1994.

blackbirds and other relatively common species able to adapt to plant communities in early stages of ecological succession.

Impacts to biological diversity would be reduced if wetland enhancement was implemented on sites that have been disturbed by past activities (e.g., drained wetlands, areas converted to cropland, and mined areas). Protection and management of diverse, natural habitats would be consistent with objectives of ecosystem management. Protection alone, however, may not be adequate mitigation of wetland impacts and some enhancement or creation of wetlands may be required. Typically, jurisdictional wetland mitigation under Section 404 of the Clean Water Act requires creation of new wetlands to offset losses that would occur. The intent of mitigation under the Clean Water Act is to ensure no net loss of wetland functions and values.

4.25.4 Aquatics/Fisheries

Impacts to aquatics and fisheries would involve tradeoffs, since the availability of water in the basin is finite. Water used for wetlands enhancement could adversely affect habitat elsewhere, depending on the source from which it was taken. If water rights were acquired that were previously applied to agriculture, aquatic/fisheries habitat would be enhanced. If sources supplying existing aquatics/fisheries habitat were used, tradeoffs would need to be made as to the functions and values of the habitats involved. Impacts to water quality either beneficial or adverse, would indirectly affect aquatics/fisheries as well. Enhancing aquatic habitat would benefit aquatics and fisheries species by stabilizing their habitat requirements and indirectly could offer increased angling opportunities.

4.25.5 Wildlife

Effects on wildlife would be dependent on the site and habitat types involved. Conversion of upland sites to wetlands may increase breeding habitat for some species of waterfowl, (primarily "puddle ducks" such as mallard and teal) if dense stands of vegetation are present for nesting near the water bodies. Amphibians and reptiles may be able to use wetlands if existing populations of these animals are close enough to created wetlands to colonize them. In the project area, it is extremely difficult for amphibians and reptiles to disperse over vast areas of semi-arid upland habitat to colonize newly created, isolated wetlands. Migratory shorebirds and waterfowl would likely use created wetlands for nesting and feeding in spring and fall. Landownership changes could result in permanent protection of habitat, and therefore should be beneficial to wildlife. Providing nesting structures for birds should increase numbers of birds fledged from the basin. Location and numbers of structures installed would determine the extent and magnitude of this beneficial impact.

4.25.6 Vegetation

Overall impacts to vegetation from enhancement activities should be beneficial because of riparian plantings, wetland creation, livestock exclusion, noxious weed control, and more stabilized water levels. Mitigation and enhancement measures to convert native prairie habitats to artificial wetlands would cumulatively reduce amounts of native prairie habitat remaining in the Northern Great Plains. Agricultural development, overgrazing, mining, residential development, and other activities have reduced native prairie and associated wildlife populations which have a strong affinity for native grasslands and shrublands. Regionally, native prairie habitat is still present over large acreages, particularly on federally-managed lands.

4.25.7 Biodiversity

Enhancement activities that would have a high potential for increasing or protecting biological diversity include: acquiring and protecting lands with high habitat values; enhancing wetland and riparian habitat that has been degraded; establishing shelterbelts, nesting cover, and food plots; restoring native prairie species and habitat; enhancing instream flows; providing fish passages around irrigation diversions; installing bird nesting structures; and controlling noxious weeds. In addition, cooperative and educational programs with landowners would increase awareness of biodiversity and ecosystem protection in the basin.

To be consistent with the goals of ecosystem management, ecological functions and values of creating wetlands in native prairie habitat need to be evaluated relative to losses that would occur from this conversion. Conversion of native plant communities to artificial wetlands may conflict with ecosystem management guidelines which specify that: native species and habitats should be protected; rare and ecologically important species be protected; habitat fragmentation be minimized; and natural ecosystem processes be maintained.

4.25.8 Social Conditions

Impacts on social conditions would be beneficial and indirect and would generally improve natural conditions so that human activities on enhanced lands gave greater opportunity for enjoyment, education, recreation, plant gathering, and/or other cultural activities.

4.25.9 Economic Conditions

All enhancement features would impact economic conditions because: 1) they would require funding from government agencies and 2) would provide employment within the basin, primarily to the Northern Cheyenne. Economic effects could include minor fiscal impacts due to conversion of private-to-public landownership and possible loss of agricultural production. Economic effects would depend on the type of acquisition (e.g., fee title or conservation easement) and management prescriptions for acquired sites (e.g., some might remain in agricultural production for waterfowl habitat). Enhancement of some resources, such as fisheries, could draw more tourism to the basin.

4.25.10 Recreation

Impacts to recreation from enhancement would be indirect and could be both beneficial and adverse. Loss of access to and changes in use of properties in the basin may occur. Native prairie/ecosystem management programs may provide bison for hunting and/or viewing on the reservation. Overall, impacts to hiking, hunting, fishing, and wildlife viewing would be minor and beneficial unless key recreational sites were altered by enhancement.

4.25.11 Land Use and Ownership

Land/site acquisition could result in minor fiscal impacts due to conversion of private-to-public ownership in the basin. It is assumed that if the project sponsors acquired land for enhancement features, it would be more accessible to the public for recreation purposes. Impacts to land use and ownership are dependent on the specific site, the acquisition method, and the ultimate management of the site.

4.25.12 Cultural Resources

Any enhancement feature that involved land disturbance could impact cultural resources. Such activities would require further environmental review and consultation.

4.25.13 Visual Resources

Most enhancement activities would improve visual resources by maintaining or enhancing natural features such as vegetation. Structural improvements, such as stock waterers and fish passages, would have only negligible visual impacts.

CHAPTER 5 CONSULTATION AND COORDINATION

5.1 AGENCIES AND COMPANIES CONSULTED

In the course of preparing this draft EIS, the project sponsors and preparers of this document consulted and coordinated with a variety of agencies and companies.

- Members of the Northern Cheyenne Tribe were contacted about social customs and beliefs, ethnobotanical resources, and tribal services provided on the reservation.
- Montana Department of Fish, Wildlife and Parks was contacted to provide consultation on fish and wildlife matters and about improvements to existing facilities at Tongue River State Park.
- Montana State Historic Preservation Officer was contacted regarding cultural and historic resources in the area.
- Montana Department of Natural Resources and Conservation provided information about dam safety, hydrological evaluations, conceptual engineering design, mine mitigation, Native American workforce agreements, authorizing legislation, riparian and wetland mitigation, terrestrial and aquatic enhancement planning, landownership and access, reasonably foreseeable projects, and water rights.
- U.S. Bureau of Reclamation provided information about the Indian Trust Asset Assessment, conceptual engineering design, terrestrial and aquatic enhancement planning, reasonably foreseeable projects, the Biological Assessment, and mitigation planning.
- U.S. Army Corps of Engineers, Omaha District, was contacted about wetlands and Waters of the U.S.
- Montana Department of Transportation, Wyoming Department of Transportation, and Big Horn County were contacted about impacts to affected roadways, transportation corridors, and planned road projects in the area.
- Montana Department of Health and Environmental Sciences was contacted about air and water quality issues.
- U.S. Fish and Wildlife Service was contacted about federal threatened and endangered species, wetlands, and general wildlife issues in the proposed project area.
- Sheriff's departments in Big Horn and Rosebud counties, Montana, and Sheridan County, Wyoming, and the Montana Highway Patrol and Bureau of Indian Affairs Law Enforcement Office were contacted about law enforcement and traffic impacts.
- School districts in Big Horn County, Montana, were contacted about the impact of additional students to area schools.

- Montana Department of State Lands was contacted about coal mines in the area and alluvial valley floors.
- Interstate Commerce Commission was contacted about the proposed Tongue River Railroad.
- Tongue River Railroad Company was contacted about the proposed Tongue River Railroad.
- Sheridan Area Water Supply Joint Powers Board was contacted about the proposed Twin Lakes project.
- Burlington Northern Railroad was contacted about rail facilities in the project area.
- U.S. Forest Service (Sheridan, WY) was contacted about the proposed Tie Hack project.

5.2 REVIEW OF THIS DOCUMENT

This EIS has been mailed to all parties who have expressed an interest in receiving it. Additional copies of the document are available on request from the Department of Natural Resources and Conservation. Copies of the EIS were mailed to the following state and federal agencies:

Montana Department of Fish, Wildlife and Parks

Montana Governor's Office

Montana Environmental Quality Council

Montana Intergovernmental Review Clearinghouse

Montana Department of Health and Environmental Sciences

Montana State Historic Preservation Office

Montana Department of Transportation

Montana Department of State Lands

Montana State University

Montana Bureau of Mines and Geology

Montana State Library

University of Montana

U.S. Bureau of Indian Affairs

U.S. Bureau of Land Management

U.S. Fish and Wildlife Service

U.S. Interstate Commerce Commission

U.S. Environmental Protection Agency

U.S. Army Corps of Engineers

U.S. Forest Service, Billings

U.S. Natural Resource Conservation Service, Hardin

U.S. Geological Survey

5.3 PUBLIC INVOLVEMENT

Public meetings have been held since 1980 in the Tongue River Basin concerning the Water Rights Compact. The Montana Reserved Water Rights Compact Commission held several meetings in the early 1990s to provide information on the progress of Compact negotiations and to ask the public for questions or comments.

Three open house meetings were held in October 1991, to inform the public about studies for rehabilitating the dam. A brochure explaining the progress of a study, *Special Report: Tongue River Dam Rehabilitation*, was mailed to more than 400 individuals, groups, and agencies. At the Miles City open house, 19 people attended. Twenty-nine people attended in Ashland and 30 in Sheridan, Wyoming.

In 1993, the Agencies conducted public scoping meetings to determine issues and concerns related to the Tongue River Basin project and to identify possible alternatives to be included in this draft EIS. Nine public meetings were held in the project area. These meeting locations, dates, and number of people attending are listed in **Table 5-1**. A record of scoping activities and meeting minutes is on file at DNRC.

TABLE 5-1
Public Scoping Meetings

MEETING LOCATION	DATE	NUMBER OF ATTENDEES
Busby	March 8, 1993	8
Lame Deer	March 8, 1993	16
Crow Agency	March 9, 1993	6
Sheridan, Wyoming	March 9, 1993	34
Birney	March 10, 1993	12
Birney Village	March 10, 1993	10
Ashland	March 11, 1993	7
Miles City	March 12, 1993	10
Billings	March 23, 1993	45

In addition to public scoping, a meeting was held on March 23, 1993 to discuss agency scoping issues. Representatives of lead permitting agencies, the consulting firm preparing the EIS, the Bureau of Indian Affairs, and a representative of U.S. Senator Conrad Burns' office were in attendance. Minutes of this meeting also are included in the scoping file at DNRC.

CHAPTER 6 PREPARERS AND CONTRIBUTORS

The following people were involved in the research, writing, and internal review of this draft EIS:

Name	Project Responsibility
MONTANA DEPARTMENT OF NATURAL RESOURCES AND CONSERVATION	
Greg Ames	Project Coordination
Larry Dolan	Hydrology
Mike Oelrich	Project Engineering
Edward Pettit	MEPA Compliance
John Sanders	Field Engineering
U.S. BUREAU OF RECLAMATION	
Mark Albers	Project Coordination/Biological Assessment/Wetlands/ Mitigation and Enhancement
NORTHERN CHEYENNE TRIBE	
Ernie Robinson	Project Coordination
William Tallbull	Cultural Resources/EthnobotanicalConsultation
Jason Whiteman, Sr.	Mitigation and Enhancement Consultation
MORRISON-MAIERLE/CSSA AND MME CORP.	
Ken Salo	Project Management/Hydrology/Engineering/Visuals
Mike Fillinger	Production Coordination/Aquatics/NEPA Compliance
Eric Oswald	Soils/Geohydrology/Geology
Clint Erb	Recreation
Bob Carroll	Aquatics/Fisheries
Jerry Hallford	Graphics
Brad Peterson	Noise/Transportation

Name	Project Responsibility
AM TECH SERVICES	
Annell Fillinger	Word Processing/Layout/Transcription
LISA BAY CONSULTING	
Lisa Bay	Editing/Land Use/Visuals
AABERG CULTURAL RESOURCES CONSULTING SERVICES	
Steve Aaberg	Ethnobotany
NORTHWEST RESOURCE CONSULTANTS	
Linda Priest	Social Sciences
ECN	
Dick Dodge	Economics
JIM GELHAUS	
Jim Gelhaus	Climate/Air Quality
JOE ELLIOTT, Ph.D.	
Joe Elliott	Vegetation/Biodiversity
ETHNOSCIENCE	
Ken Deaver	Cultural Resources
Sherri Deaver	Cultural Resources
BOB ENG, Ph.D.	
Bob Eng	Wildlife

CHAPTER 7 GLOSSARY

GLOSSARY OF TERMS

100-year flood: The 100-year flood is a flood event that has a one-in-100 chance of being equaled or exceeded in any year.

abutment: The point of contact between a spillway wall or dam embankment and a natural slope.

acre-foot: The volume of water that would cover an area equivalent to 1 acre, 1 foot deep or 43,560 cubic feet (325,851 gallons).

aggregate: Sand and gravel materials used to make concrete or roller-compacted concrete or used to surface roads.

alluvial: Pertaining to material or processes associated with transportation or deposition by running water.

alluvial valley floor: (Legal definition) The unconsolidated stream-laid deposits holding streams where water availability is sufficient for subirrigation or flood irrigation agricultural activities; but the term does not include upland areas which are generally overlain by a thin veneer of colluvial deposits composed chiefly of debris from sheet erosion, deposits by unconcentrated runoff or slope wash, together with talus, other mass movement accumulation, and windblown deposits. (Common definition) The floor of a river valley.

ambient: The existing atmosphere or environment.

anchor ice: Ice that forms in the bottom of rivers when the rest of the water is not frozen.

aquatic biota: Lifeforms that live in water.

aquatic habitat: The place or type of site within which water-dependent plants or animals normally live.

aquifer: A water-bearing layer of permeable rock, sand, or gravel.

attenuate: To lessen the force or value; to reduce severity.

auxiliary outlet works: A second outlet works that can be used to back-up or supplement the primary outlet works.

baghouse: An air pollution abatement device used to trap particulates by filtering gas streams through large fabric bags, usually made of glass fibers.

batching: Process of mixing aggregate, water, and cement to make concrete.

benchmark: A relatively permanent object bearing a marked point of elevation.

benthic: Occurring at the bottom of a body of water.

berm: A narrow shelf or ledge, typically at the top or bottom of a slope.

biomass: The amount of living matter (as in a unit of area or volume of habitat).

black water: Water containing sanitary wastes from toilets.

borrow source: An excavated area where material may be mined/removed for use as fill at another location.

breach: A break in a dam embankment created by erosion of the embankment materials or by excavation to remove a portion of a dam. A *catastrophic* breach would be due to dam failure and would release the entire storage content of the reservoir in a brief period. A *controlled* breach would drain the reservoir to reduce the storage content over an extended period.

bulkhead: A structure or partition to resist pressure; a wall.

cfs: Measure of water flow rate in cubic feet per second. One cfs is equal to about 450 gallons per minute.

capillary movement: A movement of water caused by adhesion, cohesion, and surface tension of liquid in contact with a solid.

cavitation: A hydraulic condition where a vacuum forms and results in pitting damage to exposed surfaces.

chute: The face or channel of a dam's spillway.

coffer dam: A temporary dam designed to contain and divert water away from a dam, spillway, or other structure during construction.

contiguous: Touching along a boundary, being adjacent to.

crest: The top of a dam's spillway or dam itself.

cubic yard: Volume measurement used in construction equal to a 3-foot cube or 27 cubic feet or 202 gallons.

cumulative effects: A general estimation of the effects of project impacts in combination with other past, present, and reasonably foreseeable future projects or activities.

cutoff wall: An impervious structure constructed under dams and spillways to prevent seepage and possible dam failure.

dBA: A unit of sound measurement. Decibels in the A-weighted scale.

decreed water rights: Water rights established by court decree.

demographics: Statistics having to do with the study of human population (e.g., size, density, vital statistics.)

diatom: A class of minute, blanktonic, one-celled or colonial algae.

drawdown: Lowering of reservoir elevation when releases exceed inflow.

ecosystem: The complex of a community and its environment functioning as a unit of nature.

emergency spillway: A spillway structure used to pass infrequent or large flows. Earth-lined emergency spillways may suffer damage from use.

endangered species: A wildlife species that is listed by the U.S. Fish and Wildlife Service as being in danger of extinction throughout all or a significant portion of its range.

enhancement: For purposes of this EIS, enhancement is a program of activities to increase the value of fish and wildlife habitat.

equilibrium: A state of balance between two opposing forces.

ethnobotanical resources: Plants that have a special cultural or spiritual purpose.

eutrophication: The process whereby a body of water becomes highly (biologically) productive due to the input of large quantities of nutrients. Algae blooms often result, thus depleting the water of oxygen.

exchange water: Water made available to the Northern Cheyenne Tribe from Tongue River direct flow or from Tongue River Reservoir storage in exchange for Tribal return flows made available to other Tongue River water users.

fauna: Animals.

fen: Low land covered wholly or partly with water.

fish passage: Conditions that allow fish to migrate around hydraulic structures.

floodplain: Land that may be submerged by floodwaters; a plain built up by stream deposition.

flora: Plants.

flume: An inclined channel for conveying water.

fluvial: Of or relating to a stream or river.

freeboard: Space between water surface elevation and dam crest.

freeze-thaw: Expansion and contraction action resulting from alternating freezing and thawing.

full pool: Reservoir at spillway crest elevation.

gaseous pollutants: Air pollutants in the form of gas such as sulfur dioxide, nitrogen dioxide, or carbon monoxide.

gate house: A structure on top of a gate shaft that houses gate controls.

geologic stratigraphy: The grouping of rocks by description, composition, and sequence of deposition.

geomorphology: Science dealing with the erosion and build-up of erosional materials on the earth's surface.

geotechnical: The structural limitations and engineering properties of geologic materials.

gondola car: A railroad freight car with sides and an open top used to haul coal, aggregate, and riprap.

gray water: Drain water from sinks and wash rooms.

herbaceous: A plant having little or no woody tissue and living for a single growing season.

high hazard: A dam whose failure would result in the loss of life; not a statement of condition.

historic: Significant in history.

horizonation: A distinct layer of soil, approximately parallel to the land surface, and differing from adjacent related soil layers in physical, chemical, and biological properties or characteristics.

hydrogeologic unit: A water-bearing subsurface layer or rock group.

hydrophytes: A plant growing in water or in soil too waterlogged for most plants to survive.

incremental increase: For purposes of this project, an incremental increase is a comparison of downstream flood elevations from a flood event versus downstream flood elevations from the flood event and dam break.

inflows: Water flowing into a reservoir.

intake structure: The structure in a reservoir that delivers water to the low level outlet conduit.

inundate: To cover with water, to flood.

invader species: Unwanted plant species (usually weeds) that encroach on the habitat of more desirable plant species.

invert: Lowest point or bottom of a stream channel, culvert, or tunnel.

irreversible effects: Those permanent, project-related changes that can not be reversed or restored to original conditions.

labyrinth weir: A spillway crest resembling a zigzag pattern and having a high efficiency.

lek: An assembly area where grouse carry on display or courtship behavior.

lithic: Relating to or made of stone.

low level outlet works: Conduit and gate structure through a dam which allows periodic, controlled releases from a reservoir.

macroinvertebrate: Small animals that lack a spinal column.

median: Being in the middle, intermediate between a high and low.

mitigation: Measure taken to lessen an impact.

mixing heights: Above-ground elevation where all air quality constituents are thoroughly mixed.

morphology: The external structure of rocks in relation to the development of erosional forms of topographic features.

neotropical migrant: Birds that migrate to and from the biogeographic region that includes South America, the West Indies, and tropical North America.

off-stream storage: Storage project located off a major stream course and filled using diverted water.

outflow: Releases from a project made through the outlet works or spillway.

oxbows: (Common definition) Meandering bends in a river which form an "S" shape.

particulate emissions: Finely divided solid or liquid particles discharged into the air in the form of dust, smoke, fumes, mist, spray, or fog.

peak flood flow: Maximum flow experienced during the rise and fall of a flood.

percolate: To ooze or trickle through a permeable substance.

periphyton: Organisms (as some algae) that live attached to underwater surfaces.

prehistoric: Existing in times predating written history.

primary gate: Gate in the outlet works of a dam used to make normal releases.

ppm: A measure of sediment concentrations expressed in units of sediment per million units of water.

probable maximum flood: The maximum runoff condition resulting from the most severe combination of hydrologic and meteorologic conditions that are considered reasonably possible for the drainage basin under study.

probable maximum precipitation: The largest possible precipitation event expected in an area based on the most severe combination of meteorologic conditions that are considered reasonably possible for the drainage basin under study.

project takeline: Boundary required to encompass the new reservoir area often referred to as the new high water mark.

pug mill: A concrete batching machine that allows continuous mixing of concrete materials.

railroad spur: A short track leaving the mainline and normally used to load or assemble rail cars.

reclamation: Restoring an area to a biologically productive condition.

recurrence interval: The average number of years between events of a given magnitude. For example a 50-year flood would have a normal probability of occurring once every 50 years.

reservoir margin: The area around the reservoir exposed between the high and low water marks.

riparian habitat: Habitat influenced by the presence of a stream, river, or reservoir and typically situated on the banks of such a body of water.

riprap: A layer of broken rock, cobbles, boulders, or fragments of sufficient size and thickness to resist the erosive forces of flowing or moving water.

roller-compacted concrete (RCC): A concrete mix used to construct gravity dams, placed with conveyors and/or heavy equipment, and compacted with large vibratory rollers.

rookery: The nesting or breeding grounds of a colony of birds.

run-of-river release: A reservoir operation where stream inflows equal reservoir releases.

scarifying: Loosening of compacted soil surface by mechanical means in preparation for seeding.

scoria: A light-weight aggregate. Baked and fused rock resulting from in-place burning of coal deposits.

secondary gate: Gate in the outlet works of a dam reserved for emergency operation or used during maintenance of the primary gate.

sediment trap: Condition created when flowing water carrying sediment enters a pool of still water.

settling pond: A quiet body of water used to remove suspended sediments.

sheet piling: Interlocking steel members driven into the ground to provide a seepage cutoff wall or structural support. Steel piling often is used to construct coffer dams.

siding: A short railroad track connected to the main track where unused railcars may be stored.

sill: A tabular body of igneous rock injected while molten between other types of rock.

sloughing: To fall away from, as in soil falling off a side slope.

spillway: Structure used to discharge large quantities of water around the dam without damaging the dam.

spillway design flood: The peak flood flow used to size the maximum discharge capacity of a dam project.

stationary wave: Large wave created under rapid flow conditions by a change in the alignment of the side walls of the spillway chute.

stilling basin: An open structure or excavation at the foot of a chute or spillway to reduce the energy of the descending stream.

threatened species: A wildlife species that is federally listed because it is likely to become endangered in the near future.

turbidity: Condition of water carrying suspended sediment.

well points: Temporary well casings used with pumps to dewater soil and subsoil materials to allow construction activities.

wetlands: Lands that are generally covered by shallow water or where the ground water table is very close to the surface. In the context of this document, wetlands are generally defined as marshland and riparian habitat.

CHAPTER 8 REFERENCES

REFERENCES

Aaberg, S. and W. Tallbull. 1993. *Northern Cheyenne ethnobotany of the Tongue River Reservoir area.* Prepared for Morrison-Maierle Environmental, Helena, MT.

Albers, M. 1995. *Draft biological assessment Tongue River Basin Project.* U.S. Bureau of Reclamation, Montana Area Office, Billings, MT. May 1995.

Backes, K.M. 1993. *Fish population investigations for the Tongue River, 1993.* Montana Department of Fish, Wildlife and Parks, Fisheries Division - Region Seven. December 1993.

Backes, K.M. and W.M. Gardner. 1994. *Lower Yellowstone River pallid sturgeon study III and Missouri River pallid sturgeon creel survey.* Montana Department of Fish, Wildlife and Parks, Fisheries Division, Miles City, MT in cooperation with U.S. Bureau of Reclamation, Great Plains Region, Billings, MT. (Grant Agreement No. 2-GF-60-01840, Modification 002). January 1994.

Bahls, L.L., and P. Bahls. 1977. *Algae of the Tongue River system Montana and Wyoming.* Montana Department of Health and Environmental Sciences, Water Quality Bureau, Helena, MT.

Bahls, L.L., E.E. Weber, and J.O. Jarvie. 1984. Ecology and distribution of major diatom ecotypes in the southern Fort Union coal region of Montana. U.S. Geological Survey Professional Paper.

Bechtel Corporation. 1969. *Tongue River project, basic design report.* Bechtel Corporation, San Francisco, CA.

Bergeron, D., C. Jones, D.L. Genter, and D. Sullivan. 1992. *P. D. Skaar's Montana Bird Distribution Heritage Program: fourth edition.* Special Publication No. 2. Montana Natural Heritage Program, Helena, MT.

Biggins, D., B. Miller, L. Hanebury, B. Oakleaf, R. Crete, and A. Dood. 1993. A technique for evaluating black-footed ferret habitat. *In*: J. Oldemeyer, D. Biggens, B. Miller, and R. Crete. (eds.) Proceedings of symposium on the management of prairie dog complexes for the reintroduction of the black-footed ferret. U.S. Fish and Wildlife Service Biol. Rep. 13. Washington, D.C.

Blankennagel, R.K., W.R. Miller, D.L. Brown, and E.M. Cushing. 1977. Report on preliminary data for Madison Limestone test well no. 1, NE 1/4, SE 1/4, Dec. 15, T.57.N., R.65. W. Crook County, Wyoming. U.S. Geological Survey Open File Report 77-164.

Blankennagel, R.K., L.W. Howells, W.R. Miller, and C.V. Hansen. 1979. Preliminary data for Madison Limestone test well 3, NE 1/4, SE 1/4, Sec. 35, T.2.N., R.27 E., Yellowstone County, Montana. U.S. Geological Survey Open File Report 79-745.

Boggs, K. 1984. Succession in riparian communities of the lower Yellowstone River, Montana. Master's thesis, Montana State University, Bozeman.

Bradley, C., F. Reintjes and J. Mahoney. 1991. *The biology and status of poplars in southern Alberta.* World Wildlife Fund, Canada.

Brown, D.S., R.K. Blankennagel, J.F. Busby, and R.W. Lee. 1977. Preliminary date for Madison Limestone test well, SE 1/4, SE 1/4, Sec. 18, T.I. N., R. 54.E., Custer County, Montana. U.S. Geological Survey Open File Report 77-863.

Bryan Jr., W.L. 1985. Montana's Indians - yesterday and today. Vol. 2 Montana Geographic Series. *Montana Magazine.*

Deaver, K. and S. Deaver. 1988. *Prehistoric cultural resource overview of southeast Montana, Vol 1.* Report by Ethnoscience for Bureau of Land Management, Miles City, MT.

Dry Fork Energy Storage Project. No date. Dry Fork energy storage project: an overview. Sheridan, WY. Typescript.

Dusenberry, V. 1955. *The Northern Cheyenne - All they have asked is to live in Montana.* Montana Heritage Series Number 6. Helena: Montana Historical Press

Economic Consultants Northwest. 1994. Tongue River Dam EIS water rights contracts survey summary report. March 1994. Typescript.

Elser, A., M. Gorges, and L. Morris. 1980. Distribution of fishes in southeastern Montana. Montana Department of Fish, Wildlife and Parks and U.S. Bureau of Reclamation. Typescript.

Elstad, S. and S. Werdon. 1993. Draft - *Status report on blue sucker (Cycleptus elongatus)* a candidate endangered or threatened species (draft being revised). U.S. Fish and Wildlife Service. Bismarck, ND.

Eng, R. 1994. Unpublished field notes of site visit to Tongue River Reservoir. Typescript.

Feeney, M., C. Kroll, E. Quigley, C. Villalva, with assistance from J. Sooktis, and T. Risingsun. 1986. *Social and economic effects of coal development on the Northern Cheyenne Tribe.* Contract No. YA SSI-CTS-340082. Prepared for U.S. Bureau of Land Management, Montana State Office.

Finch, D. 1992. *Threatened, endangered, and vulnerable species of terrestrial vertebrates in the Rocky Mountain region.* U.S. Department of Agriculture, Forest Service. Gen. Tech. Rep. RM-215.

Fowells, H. 1965. Silvics of forest trees of the United States. *USDA Forest Service Handbook #271.*

Fread, D.L. 1988. The NWS DAMBRK Model theoretical background/user documentation. National Weather Service. Silver Spring, MD. June 1988.

GeoResearch, Inc. 1991. *The Tongue River water model draft.* Department of Natural Resources and Conservation, Water Resources Division, Engineering Bureau, Helena, MT. September 27, 1991.

Gilmore, J.S., D. Hammond, K.D. Moore, and J.F. Johnson (Denver Research Institute), and D.C. Coddington (Browne, Bortz, and Coddington). 1982. *Socioeconomic impacts of power plants.* Electric Power Research Institute, Palo Alto, California, EA-2228, Research Project 1225-4. February 1982.

Harlan Miller Tait Associates. 1985. Engineering feasibility study: *Tongue River spillway modification.* June 1985.

Harza Engineering Company. 1983. Montana Department of Natural Resources and Conservation Tongue River Basin Probable Maximum Flood.

Holten, G. 1990. *A field guide to Montana fishes.* Montana Department of Fish, Wildlife, and Parks. Helena, MT.

International Conference of Building Officials. 1991. *Uniform building code 1991 edition.* ISSN 0896-9655 Whittier, CA. May 1, 1991.

Interstate Commerce Commission. 1992. *Draft environmental impact statement, Tongue River Railroad Company - Construction and operation of an additional rail line from Ashland to Decker, Montana.* Finance Docket No. 30186 (SUB-NO.2) July 17, 1992.

_________. 1994. *Supplement to draft environmental impact statement: Tongue River Railroad Company - Construction and operation of an additional rail line from Ashland to Decker, Montana.* Section of Environmental Analysis. Finance Docket No. 30186 (Sub. No. 2). March 17, 1994.

Keystone 1991. *Final consensus report on the Keystone policy dialogue on biological diversity of federal lands.* Keystone Center, Keystone, CO.

Klarich, D.A., and S.M. Regele. 1980. *Southern Fort Union coalfield region of southeastern Montana.* Prepared for Bureau of Land Management and U.S. Geological Survey by Montana Department of Health and Environmental Sciences, Water Quality Division.

Knowles, C., P. Knowles, B. Giddings, and A. Dood. 1995. Status of the swift fox in Montana. Manuscript submitted for publication. FaunaWest, Boulder, MT.

Lesica, P. and S. Shelly. 1991. *Sensitive, threatened, and endangered vascular plants of Montana.* Montana Natural Heritage Program. Occasional Publication No. 1.

Lewis, B.D. and R.S. Roberts. 1978. Geology and water-yielding characteristics of rocks of the Northern Powder River Basin, southeastern Montana. Map I-847-D. U.S. Department of Interior, U.S. Geological Service.

Lockhart, L. and T. McEneaney. 1978. *The effects of coal development on the ecology of birds of prey in southeastern Montana and northern Wyoming.* U.S. Fish and Wildlife Service. Denver Res. Center.

Lopach, J.J., M.H. Brown, and R.L. Clow. 1990. *Tribal government today - politics on Montana Indian reservations.* Boulder: Westview Press.

Martin, P.R., K. DuBoise, and H.B. Youmans. 1981. *Terrestrial wildlife inventory in selected coal areas, Powder River resources area; final report.* Montana Department of Fish, Wildlife and Parks.

Meschnick, J.C., J. Smith, L. Gray, R. Peterson, D. Gentz and R. Smith. 1971. *Soil Survey of Big Horn County Area, Montana.* United States Departments of Agriculture and the Interior in cooperation with the Montana Agricultural Experiment Station.

Miles, S. and P. Hansen. 1992. *Tongue River Reservoir vegetation inventory and mapping. Final Report.* Montana Riparian Association. Montana Forest and Conservation Experiment Station, School of Forestry. University of Montana, Missoula.

Montana Bureau of Mines and Geology. 1980. Stratigraphic nomenclature chart for Montana and adjacent areas. Compiled by C.A. Balzer. Geologic Map 8.

__________. No date. *Emmissible Limits for Inorganic Constituents in Water.* Form 196, Water Quality Parameters and Their Significance.

Montana Department of Agriculture. 1993. *Montana agricultural statistics.* Helena, MT.

Montana Department of Commerce. 1980 and 1990. *Annual Financial Reports.* Local Government Services Division, Helena, Montana.

Montana Department of Fish, Wildlife and Parks. 1991 and 1993. *Montana statewide angling pressure.* Wildlife Research Bureau, Bozeman, MT.

__________. 1993. *Fish population investigations for the Tongue River.* Fisheries Division - Region Seven. Kenneth M. Backes. December 1993.

__________. 1994. Lower Yellowstone River Pallid Sturgeon Study III and Missouri River Pallid Sturgeon Creel Survey. Fisheries Division, Miles City, Montana in Cooperation with U.S. Bureau of reclamation Great Plains Region, Billings, Montana, (Grant Agreement No. 2-FG-60-01840, Modification 002). Kenneth M. Backes and William M. Gardner. January 1994. Typescript.

__________. 1994a. Upland game birds habitat enhancement program guidelines.

__________. No date. Survey and Inventory of Warmwater Lakes. Statewide Fisheries Investigations Project No. F-46-R-6. Job No. IV-E. Tongue River Reservoir Creel Project Period July 1, 1992 through June 30, 1993. Phillip A. Stewart.

Montana Department of Labor and Industry. 1992. Employment and Unemployment Data. Research and Analysis Bureau, Helena, MT. Typescript.

Montana Department of Natural Resources and Conservation. 1981. *The Tongue River Dam Rehabilitation Project.* Water Resources Division, Helena, Montana.

_________. 1985. *Tongue River Dam study planning report and preliminary environmental review.* March 1985.

_________. 1991. *Montana's Tongue River Dam: the problems and prospects.* Helena, MT. April 1991.

_________. 1992. *Tongue River Dam emergency plan; and guide to emergency procedures at Tongue River Dam.* Water Resources Division, Engineering Bureau. August 1992.

_________. 1993. Tongue River Reservoir recreation survey. Memorial Day Weekend, May, June 1993. Typescript.

_________. 1994. *Preliminary feasibility analysis of Tongue River hydropower.* Helena, MT. February 7, 1994.

Montana Department of Revenue. 1993. *Biennial Reports.*

Montana Department of State Lands. 1992. *Meridian Minerals Company Bull Mountains Mine No. 1 final environmental impact statement.* Helena Office, Helena, Montana.

Montana Fish and Game Commission. 1976. *Application for reservation of water in the Yellowstone River Basin.* Helena, MT. November 1976.

Montana Office of Indian Affairs. 1994. *Profile of the Montana Native American - 1994.* Coordinator of Indian Affairs Office, Capitol Station, Helena, MT.

Montana Office of Public Instruction. 1992, 1993, 1994. Montana Public School Enrollment Data. Typescript.

Montana Office of Public Instruction and Montana Board of Crime Control. No date. *Sorting Out Services - An American Indian guide to human resource services in Montana.*

Montana Outdoors. 1975. The Tongue River. Montana Department of Fish, Wildlife, and Parks. Helena, MT.

Montana Reserved Water Rights Compact Commission. 1990. *Land and water resources of the Northern Cheyenne Indian Reservation, staff report.* Department of Natural Resources and Conservation, Helena, Montana.

Montana Tax Foundation, Inc. 1993. *Montana taxation.* Annual Reports. Helena, MT.

Morrison-Maierle/CSSA. 1994. *Draft report on evaluations of 100-year floodplain and dominant discharge for the Tongue River Dam draft EIS.* Project No. 1447.016-004-0112. Helena, MT. November 22, 1994.

National Planning Association Data Services, Inc. 1993. *Bulletin No. 842.* Washington, D.C. May 1993.

Northern Cheyenne Tribe, Montana Department of Natural Resources and Conservation, and U.S. Bureau of Reclamation. 1992. *Special report Tongue River Dam rehabilitation.* November 1992.

Oelrich, M.J. 1994. *Tongue River Dam project embankment stability.* Department of Natural Resources and Conservation, Water Resources Division, Water Projects Bureau, Project Rehabilitation Section. January 31, 1994.

Office of Legislative Fiscal Analysis. 1993. Coal tax data. October 1993. Typescript.

Office of Surface Mining, Reclamation, and Enforcement. 1985. Reconnaissance maps to assist in identifying alluvial valley floors, Powder River Basin, Montana and Wyoming. U.S. Dept. of the Interior.

PRC Engineering. 1986. *Tongue River Dam risk assessment.* Prepared for Department of Natural Resources and Conservation. December 1986.

Parker, J.L. 1971. *Soil survey of Powder River area, Montana.* United States Departments of Agriculture and the Interior in cooperation with the Montana Agricultural Experiment Station.

Peterson, J. Ibanez, and J. Brownell, eds. 1995. *Cultural resources investigation of the Tongue River Dam project and potential irrigation developments on the Northern Cheyenne Reservation.* Report prepared by Ethnoscience for the Montana Department of Natural Resources and Conservation, Helena, MT.

Phillips, R., A. Wheeler, J. Lockhart, T. McEneaney and N. Forrester. 1990. *Nesting ecology of golden eagles and other raptors in southeastern Montana and northern Wyoming.* U.S. Fish and Wildlife Service. Tech. Rep. 26, Washington, D.C.

Reel, S., L. Schassburger, and W. Rudiger. 1989. *Caring for our natural community*: Region 1 - threatened, endangered, and sensitive species program. U.S. Forest Service Northern Region Report, Missoula, MT.

Sheridan Area Water Supply Joint Powers Board. 1992. *Twin Lakes Reservoir enlargement and rehabilitation project environmental assessment.* May 1992.

Slagle, S.E., et al. 1983. *Hydrology of area 49, Northern Great Plains and Rocky Mountain coal provinces, Montana and Wyoming.* U.S. Geological Survey Water Resources Investigations Open File Report 82-682.

Sumner, J. 1979. Montco peregrine falcon survey. Prepared for Montco. Billings, MT. Typescript.

U.S. Bureau of the Census. 1991. 1990 Census of population and housing - Summary tape files. Processed by Census and Economic Information Center, Montana Department of Commerce, Helena, Montana.

_________. 1980. *1980 Census of Population.* Bureau of the Census.

_________. 1994. Employment and income data. Bureau of Economic Analysis. June 1994. Typescript.

U.S. Bureau of Reclamation. 1985. *Tongue River Dam study planning report and preliminary environmental review.* Report to Montana Department of Natural Resources and Conservation, U.S. Department of Interior, Bureau of Reclamation, Billings, Montana.

_________. 1989. *Tongue River Dam threat to life assessment.* U.S. Department of Interior, Bureau of Reclamation. Billings, MT. December 1989.

_________. 1989a. *Policy and procedures for dam safety modification decisionmaking.* U.S. Department of Interior, Bureau of Reclamation. Denver, CO. April 1989.

U.S. Department of Agriculture. 1994. *Evaporation pond design for agricultural wastewater disposal.* USDASCS, Montana Technical Note: Environment, No. 7. Bozeman, MT.

U.S. Department of Health and Human Services. 1994. *Northern Cheyenne service unit profile - Fiscal year 1994.* Public Health Service, Indian Health Service, Billings, Montana

U.S. Department of the Interior. 1983. *Draft alluvial valley floor identification and study guidelines.* Office of Surface Mining, Denver, CO.

_________. 1994. Reservation Data. Bureau of Indian Affairs, Law Enforcement Services, Billings, Montana. May 20, 1994 Typescript.

U.S. Department of the Interior, Fish and Wildlife Service. 1992. *Fish and wildlife coordination act report for the Tongue River Dam rehabilitation project, Montana.* Region 6, Helena, Montana. April, 1992.

_________. 1994. Endangered and threatened wildlife and plants; animal candidate review for listing as endangered or threatened species. *Federal Register.* Vol. 59, No. 219. 50 CFR Part 17.

U.S. Department of Transportation. 1982. *Procedures for Abatement of Highway Traffic Noise and Construction Noise.* Federal Highway Administration, Federal Highway Program Manual, Vol. 7, Chapter 7, Section 3. August 9, 1982.

U.S. Geological Survey. 1992. *Water resources data: Montana water year 1991.* MT-19-1. Billings, Montana.

Watson, J.H. and A. Stewart. 1991. *Lower Yellowstone River pallid sturgeon study.* Montana Department of Fish, Wildlife and Parks.

Weist, T. 1977. *A History of the Cheyenne People.* Billings: Montana Council for Indian Education.

Werdon, W. 1993. *Status report on sturgeon chub (Machybopsis gelida), a candidate endangered species.* U.S. Fish and Wildlife Service. Bismarck, ND.

Western Water Consultants, Inc. 1993. *Tongue River Dam rehabilitation project mitigation of impacts of non-mine facilities and structures.* Prepared for Montana Department of Natural Resources and Conservation. June 1993.

_________. 1994. *Tongue River Dam rehabilitation project Decker Coal Mine mitigation study.* Prepared for Montana Department of Natural Resources and Conservation.

Whalen, S.C. 1979. The chemical limnology and limnetic primary production of the Tongue River Reservoir. Masters thesis, Montana State University, Bozeman.

Woessner, W.W., T.J. Osborne, E.L. Heffern, C. Andrews, J. Whiteman, W. Spotted Elk, and D. Morales-Brink. 1981. *Hydrologic impacts from potential coal Mining-Northern Cheyenne reservation.* Volume I, Office of Research and Development. U.S. Environmental Protection Agency, Cincinnati, OH.

Wyoming Department of Employment. 1994. Employment Statistics. Cheyenne, Wyoming. Typescript.

INDEX

APPENDIX A

APPLICABLE LAWS, REGULATIONS, AND AGENCY INVOLVEMENT

APPLICABLE LAWS, REGULATIONS, AND AGENCY INVOLVEMENT

- The following environmental laws and regulatory authorities are applicable to this project:

- **Endangered Species Act**

  Reclamation prepares a biological assessment to determine project effects on threatened and endangered plant and animal species listed or proposed for listing (candidate species) under the Endangered Species Act (16 U.S.C., § 1531 et seq.). U.S. Fish and Wildlife Service (USFWS), then issues an opinion on whether federal actions are likely to jeopardize the continued existence of a threatened or endangered species, or destroy or adversely modify critical habitat. USFWS must approve the preparation of a biological assessment to comply with the Endangered Species Act in order to render its decision. If USFWS determines that the preferred alternative would jeopardize the continued existence of a species, it may offer a reasonable and prudent alternative that would preclude jeopardy.

- **Laws and Regulations Addressing Cultural Resources**

  Because federal properties and funding are involved, a consideration of effects on cultural resources must be undertaken, as required under the following laws and regulations; the National Historic Preservation Act (NHPA) of 1966 (16 U.S.C. § 470 et seq.); the National Environmental Policy Act (NEPA) of 1969 (42 U.S.C., § 4321) ; the Archaeological Resources Protection Act (ARPA) of 1979 (16 U.S.C. § 470aa et seq.); the National Park Services (NPS) procedures concerning the National Register of Historic Places (NR) (36 CFR Part 60); the Advisory Council on Historic Preservation's Procedures for the Protection of Cultural Properties (36 CFR Part 800); the Treatment of Archaeological Properties of 1980; Determination of Eligibility for Inclusion in the NR (36 CFR 63); the Secretary of the Interior's Standards and Guidelines for Archaeological Historical Preservation of 1983; Reservoir Salvage Act of 1960; the 1974 Amendment to the Reservoir Salvage Act of 1960; and the Montana Antiquity Act of 1979 (MCA 22-3-424). In addition, consultation with relevant Native American groups concerning traditional cultural properties is required under the American Indian Religious Freedom Act of 1978 (AIRFA, P.L. 95-341, 42 U.S.C. § 1996) and Section 4 of ARPA of 1979. Guidelines for evaluation of traditional cultural properties are contained in Bulletin 38 issued by the National Park Service.

- **Section 404 of the Clean Water Act**

  Section 404 of the Clean Water Act (33 U.S.C. § 1344) authorizes U.S. Army Corps of Engineers (COE) to regulate activities that would place fill in wetlands and surface waters. The proposed project would fall under jurisdiction of the Corps of Engineers because fill would be placed in surface waters as a result of constructing a bridge across the Tongue River, downstream of the dam; constructing a coffer dam during the construction phase of the project; conducting construction activities below the normal high water line; and placing riprap to prevent erosion of embankments protecting Montana Highway 314 and Decker Mine facilities. Detailed site-specific wetland delineation studies will be conducted in the spring and early summer of 1995.

COE and the U.S. Environmental Protection Agency (EPA) have developed guidelines to evaluate impacts from dredged or fill disposal activities on Waters of the U.S. and to determine compliance with Section 404 of the Clean Water Act (33 CFR § 323 et seq; 40 CFR § 230 et seq.). The guidelines require analysis of "practicable" alternatives that would not require disposal of dredged or fill material in Waters of the U.S., or would result in less environmental damage. Under the guidelines, the term "practicable" means "available or capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes." EPA also reviews 404 permit applications and has veto power under the Clean Water Act for decisions made by COE on 404 permit applications.

- **Federal Land Policy and Management Act**

  Under the Federal Land Policy and Management Act (43 U.S.C. § 1701 et seq.), a special use permit would be required from the U.S. Bureau of Land Management (BLM) for flood easements over BLM lands and if any new electrical transmission lines were required by the project.

- **Montana Water Use Act**

  DNRC administers the Montana Water Use Act (MCA 85-2). A water rights permit is required by the Act for any surface water diversion or ground water withdrawal exceeding 35 gallons per minute and with an annual volume of 10 acre-feet or more for any type of use prior to construction. Notice of Completion of the well must be filed with DNRC within 60 days. The water well driller must hold a license from the Board of Water Well Contractors.

- **Montana Dam Safety Act**

  DNRC administers the 1985 Montana Dam Safety Act (MCA 85-15) which addresses high hazard dams. A high hazard dam is defined as any dam that impounds 50 acre-feet or more and could cause loss of life downstream if it failed. Tongue River Basin Project is classified as a high hazard project, although this is not necessarily a classification of the dam's condition.

  Under the Act, an operating permit would be required to operate the Tongue River Basin Project from year to year. A construction permit would be required before any major repair, alteration, or enlargement could begin. The design and construction of repairs to the existing dam must meet minimum requirements outlined in ARM 36.14.101 through 36.14.803 adopted by DNRC.

- **National Environmental Policy Act (NEPA)**

  NEPA (42 U.S.C. § 4321 et seq.) requires adherence by federal agencies to regulations minimizing adverse environmental impacts on projects involving federal lands or funding. Reclamation has been designated as the lead federal agency for NEPA compliance related to this project.

- **Montana Environmental Policy Act (MEPA)**

  MEPA (MCA 75-1-101 et seq.) requires adherence by state agencies to regulations minimizing adverse environmental impacts on projects involving state property or funding. DNRC has been designated as the lead agency for MEPA compliance related to this project.

- **Northern Cheyenne - Montana Water Rights Compact (Compact) and Northern Cheyenne Indian Reserved Water Rights Settlement Act**

  Reclamation has a trust responsibility to protect and maintain water rights reserved by or granted to Indian tribes or individuals by the Act. In conjunction with other participating agencies, DNRC implements the provisions of the Compact and provides for repairs and improvements of the state-owned Tongue River Dam.

- **Montana Clean Air Act**

  The Department of Health and Environmental Sciences (DHES) administers the Montana Clean Air Act (MCA 75-2-101 et seq.). Any project having estimated pollutant emissions (without emission controls) exceeding 25 tons per year must obtain an air quality permit from the Air Quality Division. The permit would stipulate air emissions, limitations, and monitoring requirements. Best Available Control Technology must be applied to each emission source and it must be demonstrated that the project would not violate state or federal Ambient Air Quality Standards.

- **Montana Water Quality Act**

  The DHES Water Quality Division (WQD) administers the Water Quality Act (MCA 75-5-101 et seq.). This law sets forth classification of surface and ground water uses and establishes water quality standards. The WQD administers the Montana Pollutant Discharge Elimination System (MPDES) permit system, including storm water permits and nondegradation waivers. A short-term exemption (3A authorization) from Surface Water Quality Standards for turbidity may be required for dam construction and related facility stream crossings.

  EPA has oversight responsibility for federal Clean Water Act programs delegated to and administered by the State Water Quality Division. EPA also may intervene to resolve interstate disputes where discharges of pollutants in an upstream state may affect water quality in a downstream state.

- **Montana Hazardous Waste Act**

  The DHES Solid and Hazardous Waste Division is responsible for reviewing construction procedures and power line installation to ensure compliance with solid and hazardous waste laws and regulations (MCA 75-10).

- **Montana Solid Waste Management Act**

  The waste area for disposal of construction waste materials would have to be permitted, opened for use, and closed under criteria established by DHES for a Class III landfill (MCA 75-10).

- **Montana Stream Preservation Act**

  Construction activity by a public agency that would include the construction of new facilities or modifications, operation and maintenance of an existing facility that may affect the natural shape and form of any stream, or its banks or tributaries would require a Stream Preservation Act (SPA 124) permit. The purpose of this permit is to protect fish and wildlife resources and to maintain streams and rivers in their natural or existing state. This permit is administered by Montana Department of Fish, Wildlife and Parks and a Notice of Construction application would be required before construction on the Tongue River Basin Project could begin.

- **Open Cut Mining Permit**

  Development of aggregate source sites No. 1 and No. 2 would require agreements with, and the necessary open cut mining permit from, Department of State Lands. No mining would be allowed until entering into a reclamation contract with the Board of Land Commissioners.

- **Montana Floodplain and Floodway Management Act**

  A Floodplain Development Permit would be required for new construction in a designated 100-year floodplain from DNRC. New construction includes the placement of fill, roads, bridges, culverts, power lines, storage of equipment or materials, or excavation within a designated 100-year floodplain. The 100-year floodplain on the Tongue River Basin within Big Horn County has been delineated and the county is participating in the National Flood Insurance Program. Floodplain development permits are administered by the local county floodplain administrator and a permit would be required before construction on the Tongue River Basin Project could begin.

- **Fish and Wildlife Coordination Act**

  U.S. Fish and Wildlife Service conducts a study under the Act and makes recommendations to federal agencies to mitigate fish and wildlife impacts associated with project activities.

APPENDIX B

BIOLOGICAL ASSESSMENT

DRAFT BIOLOGICAL ASSESSMENT
TONGUE RIVER BASIN PROJECT

Prepared by
Mark Albers
United States Bureau of Reclamation
May 1995

PROJECT DESCRIPTION

The Tongue River Basin Project is a result of the "Northern Cheyenne Indian Reserved Water Rights Settlement Act of 1992" (P.L. 102-374, 106, Stat. 1186). The major elements of the project include repairing and enlarging the Tongue River Dam and implementing various fish and wildlife habitat enhancement projects in the Tongue River Basin.

To address the elements listed above the United States Bureau of Reclamation, the Northern Cheyenne Tribe, and the Montana Department of Natural Resources and Conservation (Project Sponsors) are analyzing two action alternatives, a no-action alternative, and a programmatic list of enhancement features. The enhancement features will be implemented in conjunction with either action alternative. Each of the action alternatives involves replacing the existing spillway and raising the crest elevation an additional 4 feet.

AFFECTED AREA

The Tongue River flows approximately 100 miles from its headwaters in Wyoming's Bighorn Mountains to Montana's Tongue River Dam, which is located a few miles north of the Wyoming border and 189 river-miles southwest of the Tongue's mouth on the Yellowstone River at Miles City (Figure 1). The Tongue River Dam, owned by the State of Montana, was completed in 1940. It is administered by DNRC and the Tongue River Water Users Association.

The existing Tongue River Reservoir is impounded by a 91-foot-high dam and occupies a section of the Tongue River Valley wider and flatter than the sections immediately above and below the reservoir. The Fort Union formation dominates the surface geology. This formation consists of soft, silty, sandstone, clay shales, and coal beds. Porcellanite and clinker, caused by burned coal deposits, have formed in adjacent shale beds.

Water development projects constructed in the basin since the turn of the century have significantly altered the seasonal hydrograph, sediment transport mechanisms, temperature regime, and morphology of the Tongue River. Additionally, many of these projects represent total or partial barriers to fish passage in the river.

The most significant impacts to terrestrial habitats will occur in the immediate vicinity of the Tongue River Reservoir. Aquatic habitat impacts are also expected to be greatest at the reservoir site and the upper reaches of the river, but may potentially extend downstream to the mouth.

FEDERALLY LISTED THREATENED AND ENDANGERED SPECIES

Federally listed Threatened and Endangered (T&E) species and Category 1 and 2 Candidate species of fish, birds, herps or plants that may occur on or near the project area, or which may potentially be affected by the project, are listed below. Six species have been designated as T&E under the Endangered Species Act of 1973, and as amended. An additional 22 species are designated as Category 1 and 2 Candidate species.

Threatened and Endangered Species

Bald eagle	*Haliaeetus leucocephalus*	Endangered
Peregrine falcon	*Falco peregrinus*	Endangered
Piping plover	*Charadrius melodus*	Threatened
Least tern	*Sterna antillarum*	Endangered
Pallid sturgeon	*Scaphirhynchus albus*	Endangered
Black-footed ferret	*Mustela nigripes*	Endangered

Category 1 Candidate Species

Category 1 indicates taxa for which the United States Fish and Wildlife Service (Service) has on file sufficient information on biological vulnerability and threats to support proposals to list as threatened and endangered.

Mountain plover	*Charadrius montanus*
Sturgeon chub	*Macrhybopsis gelida*
Sicklefin chub	*Macrhybopsis meeki*

Category 2 Candidate Species

Category 2 indicates taxa for which the Service has information indicating that proposing to list is possibly appropriate but for which conclusive data on biological vulnerability and threat currently are not available to support a proposal to list.

Spotted bat	*Euderma maculatum*
Small-footed myotis	*Myotis cilioabrum*
Long-eared myotis	*Myotis evotis*
Long-legged myotis	*Myotis volans*
Pale Townsend's big-eared bat	*Plecotus townsendii pallescens*
Swift fox	*Vulpes velox*
Northern Goshawk	*Accipiter gentilis*
Baird's sparrow	*Ammodramus bairdii*
Western burrowing owl	*Athene cunicularia hypugea*

Ferruginous hawk	*Buteo regalis*
Black tern	*Childonias niger*
Eastern short-horned lizard	*Phrynosoma douglasii brevirostra*
Northern sagebrush lizard	*Sceloporus graciosus graciosus*
Blue sucker	*Cycleptus elongatus*
Western silvery minnow	*Hybognathus argyritis*
Plains minnow	*Hybognathus placitus*
Flathead chub	*Platygobio gracilis*
Paddlefish	*Polydon spathula*
Persistentsepal yellowcress	*Rorrippa calycina*

HABITAT USE AND STATUS OF SPECIES

Threatened and Endangered Species

Bald Eagle

The bald eagle occurs in the project area as a seasonal migrant as well as a wintering and breeding species. Coal company biologists in the vicinity have informally monitored bald eagle wintering populations over part of the area for a period of years. Although formal winter counts over the entire river (Wyoming state line to Miles City) have not been conducted an estimated annual average of 10 eagles may winter along the river below the dam (J. Berry pers. comm. 1992). M. Humphris (pers. comm. 1992) suggests that an average of 10 to 15 eagles may use this river reach in the winter, concentrated mostly in the canyon just below the dam. A late winter count conducted on February 20, 1992 by a biologist under contract to a consulting firm revealed a total of 50 bald eagles along Tongue River between its mouth at Miles City and the upper end of Tongue River Reservoir (P. Farmer, Westech, pers. comm. 1992). According to one expert, this count probably reflects an influx of spring migrating eagles (D. Flath, MDFWP pers. comm. 1992). Although specific data are apparently lacking, a number of biologists have previously indicated the impression that the Tongue River may be an important seasonal migration corridor for bald eagles.

Bald eagles have also been seen consistently, but in small numbers, on Tongue River Reservoir, especially in late spring after most of the ice is out (J. Berry, pers. comm. 1992). These may represent birds that wintered on the river below the dam and some seasonal migrants.

During 1983-84, apparent pair-bonding activity by a pair of bald eagles was observed near a tree nest site near the Tongue River, approximately 2.5 miles downstream of the dam. No egg-laying occurred and the nest was subsequently reported to be used by nesting golden eagles (D. Flath, MDFWP, pers. comm. 1992). In spring 1992 a pair of bald eagles established a nest in a cottonwood tree about eight miles downstream from the dam. In the past few years this nest and another in the same area were apparently used interchangeably by the same pair of bald eagles (Dennis Flath, MDFWP, pers. comm. 1992). In spring 1994 one of the nests was occupied by bald eagles but was destroyed in a windstorm; the other nest was not occupied. In spring 1995 a pair of bald eagles established a new nest in a cottonwood in an old heron rookery approximately 2.5 miles downstream from the dam. Bald eagles have also successfully nested along the Tongue River upstream from the Tongue

River Reservoir (Phillips et al. 1990) and downstream between Ashland and Miles City (ICC 1992). Both these nests are also in cottonwood trees.

Peregrine Falcon

No peregrine falcon nesting territories are known to exist near enough to the project area to be of concern. Although the falcon has been sighted in the general area (Martin et al. 1981) (Decker 1990), it is assumed to be a migrant only, although at least marginally suitable nesting habitat exists in Tongue River Canyon below the dam. The MDFWP has indicated that more suitable nesting habitat is widely available in Montana and that until the species becomes more common, it appears unlikely that it would nest in this area (D. Flath, MDFWP, pers. comm. 1992). The most important consideration for assuring that the project does not potentially affect this species is to adequately provide for maintenance of suitable stream flows both after and during the roughly two-year period of project construction since the relatively high seasonal use by waterfowl of the upper reaches of Tongue River below the dam is likely to provide an important source of food for migrating peregrine falcons.

Piping Plover and Least Tern

Both the piping plover and least tern likely occur in the project area at times as seasonal migrants. However, neither species was identified by Martin et al. (1981), and discussions with a variety of biologists experienced in the general area failed to uncover any historic sightings. Nesting plovers and terns do occur in the state; a total of 89 piping plover nests and 42 least tern nests were reported in Montana in 1990 (Montana Piping Plover Committee 1991). Most of these nest sites occurred in northeastern Montana, but limited historic nesting by terns and plovers was reported on Yellowstone River sand or gravel bars, near Terry, downstream of the mouth of Tongue River.

In an effort to determine whether there is any likelihood that plover or tern nesting might be occurring or be likely to occur on the Tongue River, the evaluation team for the 1992 Tongue River Dam Project Fish and Wildlife Coordination Act Report (CAR) took two actions: (1) during field inspections in the spring and early summer of 1991, an evaluation was made of the suitability of nesting habitat for these species; and (2) several other biologists familiar with the area were consulted for their opinions concerning potential nesting.

Neither Tongue River nor the reservoir appear to offer habitat physically suitable for piping plover or least tern nesting. Most known piping plover nesting in Montana occurs on barren flats of saline or otherwise unvegetated beaches of lakes and wetlands in northeastern Montana. Some, however, occurs on wide beaches of Fort Peck Reservoir when the impoundment is low, and on rather extensive unvegetated sand bars, islands and wider beaches of the lower Missouri and Yellowstone rivers. Tern nesting is even less common and is largely confined to the same river habitats as discussed for the plover. Tongue River, however, is largely confined within incised "cutbanks"; substrate is exposed only during low water periods. Beaches and islands tend to be very narrow and subject to frequent inundation. In the reach just below the dam, fairly large cobble prevails; over much of the river the bars are quite muddy or silty. Vegetation grows very near the waterline in most areas and quickly invades the small islands and bars that become available.

Most beaches in the lower part of the reservoir are quite narrow and steep and much of the available substrate is silty or muddy. The more exposed areas at the upper end of the reservoir are quite silty and muddy. Many

have been extensively invaded by vegetation. While it may be possible that this reservoir could be used to a very limited extent by either plovers or terns, this appears unlikely, given the physical characteristics of the habitat and the reservoir's location in relation to most known plover/tern occurrences in the state.

These observations agree with the opinions expressed by other wildlife biologists experienced in the Tongue River area (D. Bricco and C. Hoff, BLM, pers. comm. 1992) (B. Giddings and A. Dood, MDFWP, pers. comm. 1992).

Pallid Sturgeon

The historic occurrence of the pallid sturgeon in Montana is known to have included the Yellowstone River at least as far upstream as the mouth of Tongue River. Many of the documented historic sightings of the pallid sturgeon in the Yellowstone River contained in a recent USFWS status report on this species (USFWS 1989) occurred at the mouth of the Tongue or very nearby in the Yellowstone. The last documented sighting in this area prior to a 1991 survey by MDFWP was, however, in 1950. Recorded occurrences of the sturgeon in the Yellowstone drainage since the 1970s had all been from below the Intake Diversion Dam, an irrigation diversion facility located some 120 miles downstream from the Tongue. Within recent years, the few confirmed sightings in the Yellowstone had all occurred near the mouth of the Yellowstone, until two catches by fishermen at Intake in the spring of 1991. Those fish, observed and tagged by representatives of the MDFWP, were released below the point of capture (P. Stewart, MDFWP, pers. comm. 1991).

It is suspected that the lack of recorded occurrences of pallid sturgeon in the Yellowstone River above Intake since 1950 is a function of the lack of specific effort to find them, combined with their obvious rarity, rather than their total extirpation from the river reach. In addition, fishery experts have stated that the aquatic habitat at the mouth of the Tongue, and of the Yellowstone River in the immediate vicinity, appears to be physically well suited to what is known of the pallid sturgeon's life history requirements (M. Dwyer, USFWS; pers. comm. 1991). High seasonal concentrations of the much smaller, but closely related, shovelnose sturgeon (*Scaphirhynchus platorhynchus*) have also been reported from this same location. This fish apparently congregates near the mouth of the Tongue River in spring months, then migrates up the Tongue to spawn when water conditions permit (Elser et al. 1977). Since the pallid sturgeon and shovelnose are closely related and have been known to hybridize (USFWS 1989), and their seasonal distributions have been widely known to overlap, it appears the known data support the opinion expressed by experts that the mouth of the Tongue River and adjacent reach of the Yellowstone continue to provide habitat suitable for pallid sturgeon. These experts have indicated informally that this area may offer some of the more promising habitat for eventual reintroduction of the pallid sturgeon into its former range, if that is determined to be a viable recovery option (M. Dryer, USFWS; pers. comm. 1991).

For the above reasons, the evaluation team constituted by the USFWS to prepare the CAR recommended that a survey be conducted for pallid sturgeon at the mouth of the Tongue River and in the Yellowstone, as part of the Tongue River Dam Rehabilitation Special Study. It was considered necessary to establish with as much certainty as possible whether or not the species still existed in the habitat considered suitable, as part of the baseline data for any assessment of potential affects of the project on the species. Subsequently, a contract between the USBR and MDFWP was executed providing for MDFWP to conduct a rather intensive survey during the spring-early summer of 1991. On the further recommendation of MDFWP fishery specialists, the contracted study area was broadened from the original proposal to include the Yellowstone River from Intake

Dam to the Cartersville Diversion Dam, located some 40 miles upstream from Miles City, and the lowermost reaches of the Tongue and Powder rivers. The Cartersville structure is considered likely to be a total block to any pallid sturgeon migrating past the Intake Diversion (P. Stewart, MDFWP, pers. comm.).

The pallid sturgeon survey was conducted from April to August 1991 (Watson and Stewart, 1991). A single pallid sturgeon was captured in a trammel net in the study reach, on July 18, near Fallon, Montana (River km 208.2). The fish was caught on the upstream side of a submerged gravel bar, in three to five feet of water. The specimen weighed 11.34 kg and had a fork length of 1,340 mm. It was disk tagged and released.

Capture of this single specimen demonstrates that the pallid sturgeon has not been extirpated from the Yellowstone River above Intake Diversion and may still reach the mouth of Tongue River. The taking in 1991 of two additional specimens from the Yellowstone just below Intake Diversion by fishermen, as described earlier, may indicate that fair numbers of this species still migrate to and possibly around the diversion structure, at least in years of moderate-to-high spring and summer runoff. These data, and the opinions of experts on the species that the mouth of Tongue River and adjacent reach of the Yellowstone provide good physical habitat for the sturgeon, suggest it may be important to the species to assure that this habitat is not adversely impacted by the proposed project.

Black-footed Ferret

Prairie dog (Cynomys sp.) towns are considered potential habitat for black-footed ferrets. The evaluation team for the CAR made an effort to determine whether prairie dog complexes existed that would be impacted by the proposed project. In addition, a professional wildlife biologist thoroughly familiar with the southern end of the reservoir area was consulted with regard to probable occurrence of prairie dogs below elevation 3428.4, the anticipated normal full pool of the enlarged reservoir. He knew of no such occurrences within his area of familiarity and doubted these would exist in light of the terrain over much of the reservoir's periphery (J. Berry, pers. comm. 1991).

A small, probably isolated, black-tailed prairie dog town located on the east side of the reservoir, in Section 1, Township 9 South, Range 40 East, near the intermittent Deer Creek drainage, might conceivably be impacted by the proposed reservoir pool. This town is located approximately .5 miles north of the East Decker Coal Mine facilities.

Black-tailed prairie dogs and their burrows are fairly abundant in downstream areas that have not been affected by the sylvatic plague. All activities associated with this project in the lower basin will be fish and wildlife habitat enhancement measures. Each of these measures will be reviewed for potential impacts to prairie dog complexes prior to the implementation of the measure.

Survey guidelines are provided by the Service in a document entitled, "Black-footed Ferret Survey Guidelines for Compliance with the Endangered Species Act, U.S. Fish and Wildlife Service, April 1989".

<u>Category 1 Candidate Species</u>

Mountain Plover

Mountain plovers are known mostly from northcentral and eastern Montana (Olson-Edge and Edge 1987; Taylor 1988) where they are associated with semi-arid grasslands, shortgrass prairie, plains and plateaus (Taylor 1988). Nesting mountain plovers prefer shortgrass prairie areas that are flat, moderately grazed, and provide short vegetation, hence most significant populations remaining in the northern region nest preferentially in prairie dog towns (Knowles et al., 1982; Olson, 1984). Suitable habitat in the project area is limited by topography and agricultural practices. Mountain plovers have not been documented in the project area (Bergeron, et al 1992; Dobkin, D.S. 1992)

Sturgeon Chub

Documentation indicates that sturgeon chub were locally abundant at some historic collection sites. Sturgeon chub are currently extremely uncommon or absent from 23 of 27 streams within their historic range. Sturgeon chub were documented in the lower reach of the Tongue River upstream of Miles City in 1926 (Bailey &Allum 1962) and again in 1980 (Elser et al. 1980). This population has since been listed as "assumed extirpated" on the basis of unsuccessful field collection attempts in 1989 and 1990 (Werdon 1992).

Sturgeon chub require turbid, free-flowing riverine habitat with a combination of rock, gravel, and/or sand substrate. They are found in greatest abundance in gravel riffles (Stewart 1981; Werdon 1992). As described under the "Affected Area" heading above, suitable habitat for the sturgeon chub has been greatly reduced or eliminated in the Tongue River in Montana. The earliest documentation of sturgeon chub in the Tongue River occurred after construction of the Tongue and Yellowstone (T&Y) Diversion Dam, 12 miles upstream from the mouth. The T&Y Dam is a complete blockage to upstream fish passage. It is not known if sturgeon chub historically utilized river reaches above T&Y.

The introduction of numerous exotic piscivorous species into systems such as the Tongue and Yellowstone Rivers may have had a profound effect on some of the native species.

Sicklefin Chub

Sicklefin chub share the same basic habitat requirements and apparent preferences as sturgeon chub. Sicklefin chub were not historically documented in the Tongue River. However, based on their association with sturgeon chub, it is reasonable to assume that suitable habitat may have existed in the Tongue River prior to the water development projects. A researcher presenting a paper at the February 1995 meeting of the Montana Chapter of the American Fisheries Society postulated that low perceived numbers of this species are due to collection techniques and not actual population depletions (Grisek, AFS Meeting 1995). In research conducted toward for his masters thesis, Grisek found that shallow-water seining for sickle fin chub was not an effective means of population sampling. Using a trawl to sample deep-water habitat adjacent to areas unsuccessfully beach seined in the Missouri River, Grisek repeatedly collected and documented sicklefin chub.

Category 2 Candidate Species

Information on distribution and occurrence of many of the Category 2 candidate species is limited or non-existent. Listed below are all Category 2 species which may occur in the project vicinity or for which suitable habitat may be available in the project area.

Spotted Bat

The global status of the spotted bat is apparently widespread but rarely abundant (Montana Natural Heritage Program 1995). In Montana there have been a few documented sightings in the south-central part of the state. Spotted bats are found in various habitats from desert to montane coniferous forest, including open ponderosa pine, pinyon-juniper woodland, open pasture, and hayfields. In British Columbia, the species forages mainly in fields near pines and over marshes (Wai-Ping and Fenton 1989). In northwestern Colorado, the species is cited as locally common in pinyon-juniper woodland, riparian corridors, and over rivers (Navo et al. 1992) The spotted bat roosts in caves and in cracks and crevices in cliffs and canyons. Presumably, suitable habitat for this species exists throughout the project area, but its presence there has not been documented.

Small-footed Myotis

The small-footed myotis occurs in most of Montana, with the possibly exception of extreme northwestern and northcentral parts of the state. It is thought to be more widespread than current documentation would suggest (Hoffman et al. 1969; Thompson 1982). In general, the species utilizes arid habitat associated with cliffs and talus slopes. In Texas, the small-footed myotis has principally been documented in mountainous wooded areas, with a few taken in grassland and desert scrub habitats (Scmidly 1991). In Canada, the species inhabits arid short-grass prairies with clay buttes and steep riverbanks. In summer, the species roosts in rock crevices, under boulders, beneath loose bark, or in buildings. The species hibernates in caves or mines. This species was documented approximately 3 miles west of the reservoir on the Spring Creek Coal Mine in 1976 (B. Lovelace, DSL; pers. comm. 1995).

Long-eared Myotis

The long-eared myotis is widespread within Montana and probably found throughout the state. It appears to be most common in coniferous forests (Hoffman and Pattie 1968; Jones et al. 1973). In general the species is found mostly near forested areas, especially those with broken rock outcrops; also shrubland, over meadows near tall timber, along wooded streams, and over reservoirs. It often roosts in hollow trees, mines, caves, fissures, etc. In Montana, the long-eared myotis is found in wooded and rocky areas (Jones et al. 1973). It has been located hibernating in a mine in riverbreaks habitat in northeastern Montana. This species was documented approximately 3 miles west of the reservoir on the Spring Creek Coal Mine in 1976 (B. Lovelace, DSL; pers. comm. 1995).

Long-legged Myotis

The long-legged myotis is very common and widespread in parts of its range. In Montana, it occurs in wide range of elevations and is probably found throughout the state (Hoffmann, Pattie and Bell 1969). In general, the species is primarily found in montane coniferous forests at 2000-3000m; also riparian and desert habitats.

The species may change its habits seasonally. It uses caves and mines as hibernacula, but its winter habits are poorly known. In summer, it roosts in abandoned buildings, rock crevices, and under loose bark, but apparently not in caves. No specific habitat-use information is available for this species in Montana. This species has been located hibernating in an abandoned mine in northeastern Montana. This species was documented approximately 3 miles west of the reservoir on the Spring Creek Coal Mine in 1976 (B. Lovelace, DSL; pers. comm. 1995).

Pale Townsend's Big-eared Bat

Pale Townsend's big-eared bat is fairly common in the west, but two eastern subspecies are listed as endangered by the U.S. Fish and Wildlife Service (44 FR 69208, 30 November 1979). Scattered records imply that the species is widespread in Montana. In Montana, the species is generally found in low population densities, occupying a range of habitats including moist forests (Thomas and West 1991) as well as arid regions (Genter and Metzgar 1985). In western Montana, they are most closely associated with cavernous habitat and rocky outcrops of sedimentary or limestone origin, which are used for roosting. Individuals are occasionally found in buildings. A major maternity colony for this species is located in the state-owned Lewis and Clark Caverns. A nursery colony was located in Lake county in 1992. Secure roosting habitat is probably the limiting factor for this species in Montana. Threats to this habitat includes reclamation of abandoned mines, cave/mine exploration and vandalism, and seismic activity and road building (Twente 1955; Humphrey and Kunz 1976; Genter 1989; Madsen et al. 1993). This species was documented approximately 3 miles west of the reservoir on the Spring Creek Coal Mine in 1976 (B. Lovelace, DSL; pers. comm. 1995).

Swift Fox

The swift fox is believed to originally have been abundant throughout its range on the Great Plains, including Montana east of the continental divide. It was extirpated early in this century from the northern portion of its range while remnant populations in the southern portion survived human settlement of the prairies. The loss of the swift fox over such a broad area prior to the advent of quantitative ecological studies has resulted in a paucity of ecological information on this species. Virtually nothing is known about the swift fox in Montana (FaunaWest 1991). Although no quantitative analysis of swift fox habitat selection has been undertaken, numerous studies indicate that swift foxes use, and prefer, short to mid-grass prairies (Cutter 1958a; Kilgore 1969; Hillman and Sharps 1978; Hines 1980; Fitzgerald et al. 1983). Prairie habitats dominated by buffalo grass or blue grama grass appear to be the areas where the highest densities of swift foxes are found in the southern portion of their range (Kilgore 1969; Hillman and Sharps 1978; Fitzgerald et al. 1983).The swift fox is known to inhabit areas of mixed agricultural use, but in lower densities.

A single swift fox was documented in Custer county in the lower portion of the project area in 1978. No other recent sightings of the species have been made in the project area. Suitable habitat for the swift fox is somewhat limited in the project area. The riparian area of the Tongue River Basin appears to be better suited to the red fox.

Northern Goshawk

The northern goshawk is closely associated with coniferous or mostly coniferous forest and open woodlands with significant old-growth components. Nests occurs in large old-growth conifers or sometimes in aspens,

especially near water (Dobkin 1992). The northern goshawk is considered a permanent resident across most of Montana. The species is known to breed in the project area (Bergeron et al. 1992). These sightings are assumed to be from the coniferous forests of the Custer National Forest on the eastern edge of the project area.

Baird's Sparrow

Baird's sparrow is a shortgrass prairie specialist endemic to the northern Great Plains. To a lesser extent the species will also use mixed tallgrass - shortgrass prairie, alfalfa fields, weedy stubble fields, and retired cropland. The species nests on the ground in slight depressions, usually well concealed by overhanging vegetation. Loss of suitable native prairie due to grazing and agricultural conversion have caused inexorable decline in Baird's sparrow populations throughout its range. The species has not been documented in the project area (Bergeron et al. 1992, Dobkin 1992) although marginal habitat may be present.

Western Burrowing Owl

The western burrowing owl inhabits prairie, grassland, meadow and open shrub steppe, but does not use structurally-similar montane habitats. The species nests in abandoned mammal (usually ground squirrel or prairie dog) burrows. Numbers are small but relatively stable in Idaho and North Dakota, although populations continue to exhibit long-term declines in Montana (Dobkins 1992). As a result of control measures that have reduced populations of colonial rodents, and as prairie and plains habitats have been converted to agriculture, burrowing owls have been reduced greatly, as well. The species is known to breed in the project area (Bergeron et al. 1992).

Ferruginous Hawk

The ferruginous hawk requires dry open country, especially native prairies, but also uses shrubsteppe, plains, and badlands. Preferred nest sites east of the continental divide in Montana are in deciduous trees, but the species also nests on cliff ledges, atop rock out crops, in deciduous shrubs, on elevated ground, and on human built structures, including haystacks (Dobkin 1992, Wittenhagen 1992). The species at times inhabits the project area and may breed there, but definitive documentation of breeding is not available (Bergeron et al. 1992). Ferruginous hawk numbers have significantly increased in Montana, slightly in North Dakota, and decreased somewhat in Idaho. Populations appear to be stable overall following marked declines in many areas beginning in the late 1940's, although the species is still uncommon in many parts of its breeding range. Loss of suitable habitat to agricultural conversion and overgrazing by livestock are the primary problems facing the species (Dobkin 1992).

Black Tern

The black tern has been sighted in the project area, but breeding activity has not been observed (Bergeron et al. 1992). The species does breed in Montana, mainly in the western part of the state and, to a lesser extent, in the north. The black tern nests in dense emergent vegetation with the eggs often just above the water. Historic operations of Tongue River Reservoir have not been conducive to black tern nesting. The seasonally fluctuating water levels do not provide suitable nesting habitat. Other wetlands in the project area may provide marginally suitable nesting habitat. The black tern is thought to be declining in many areas due largely to the

loss of wetland habitat. Greatly reduced hatching success in the upper midwest may be due to contamination with agricultural chemicals.

Short-horned Lizard

The short-horned lizard ranges from semiarid plains to high mountains. Usually occupying areas with sparse vegetation at ground level. Soil in habitat areas may vary from sandy to rocky. The species burrows into the soil or occupies rodent burrows when inactive. In southeastern Idaho the species uses sagebrush habitats the most, with females and juveniles often associated with roadsides (Guyer 1978). In southeastern Alberta the species used more habitats as the temperature increased (Powell and Russell 1985). Large amounts of presumably suitable habitat exist for this species in the project area. This species was documented in the project area in a 1981 MDFWP survey (Martin et al. 1981).

Northern Sagebrush Lizard

In southeastern Idaho, the northern sagebrush lizard prefers sage habitats (Guyer 1978). In southeast Oregon the species is observed most often in alkaline flats, basalt outcroppings, and sage. In northeast Wyoming, the species occurs on pale sandy alluvium or soil supporting big sage, rabbit brush, and greasewood. Although no specific habitat-preference data is available for Montana, conditions on the uplands in the project area closely approximate those described as preferred habitat in Wyoming. The species uses rodent burrows for overnight refuge, escape, and hibernation. The species has been documented in the project area and should be considered common in the reservoir area (B. Lovelace, DSL, pers. comm. 1995).

Blue Sucker

Blue suckers occur in the same habitats as pallid sturgeon, sicklefin chub, and sturgeon chub: turbid, free-flowing river areas. Like these associated species, the blue sucker was likely impacted by water development projects throughout its range. The blue sucker appears to be fairly abundant in the Lower Missouri and Yellowstone drainages in Montana (Gardner MDFWP, AFS Meeting 1995). The blue sucker occurs in the project area but little is known about population densities and habitat selection.

Western Silvery Minnow

The western silvery minnow occurs most commonly in the Missouri River and its larger tributaries of the prairie region. This minnow is decidedly less abundant than the closely related plains minnow in the western part of its range (Pflieger 1975). The western silvery minnow is most abundant in the low-gradient sections of clear, moderately large streams. However, it can tolerate high turbidity better than some related species. It is generally found over a silt or sand bottom in the backwaters and pools of large streams and in the quiet lower reaches of their tributaries (Pflieger 1975). The species apparently has not been documented in the project area. However, the collection of the closely related plains minnow as described below may indicate that suitable habitat exists in the project area.

Plains Minnow

The plains minnow was been documented in the project area during an electrofishing survey in 1993. One specimen was sampled in the midreach of the river (Backes 1993). The species was not documented in an earlier survey of the same area (Clancy 1980). The plains minnow is the most abundant minnow in the upper Missouri River but undergoes a gradual decline in abundance downstream (Pflieger 1975). Habitat requirements or preferences for this species are very similar to those of the western silvery minnow.

Flathead Chub

Pflieger (1975) described the flathead chub as one of the most abundant minnows in the Missouri and lower Mississippi rivers. This species inhabits a diverse range of habitats, including continuously turbid waters with swift current and sand and fine gravel bottom to moderately clear waters with little current, and bottoms composed of coarse gravel and bedrock. This species has been documented in the project area and is often found in association with sturgeon chub and sicklefin chub.

Paddlefish

The original habitat of the paddlefish consisted of large free-flowing rivers with high concentrations of zooplankton. Populations of paddlefish are maintained in reservoirs where the fish have access to spawning areas consisting of deep rocky rapids with swift currents (Pflieger 1975). During high-flow years in the Lower Yellowstone River, paddlefish are known to migrate, in large numbers at times, past the Intake Diversion Dam. A small portion of these fish move upstream past the mouth of the Tongue River to Forsyth (Stewart per comm. 1995). It is reasonable to assume that during high flow years some of these fish may occupy the lower reach of the Tongue River below the T&Y Diversion Dam. Potential use by this species would probably be concentrated near the mouth of the river. However, no documentation of such use is available.

Persistentsepal Yellowcress

Persistentsepal yellowcress is a regional endemic known from Wyoming, northwestern Nebraska, North Dakota, and Montana (Cascade, Choteau, Custer, McCone, and possibly Yellowstone counties). This species of yellowcress is mainly associated with pioneer riparian species including noxious weeds. Persistentsepal yellowcress is found at the base of slopes within riparian or palustrine habitat that is temporarily flooded; a narrow zone marking old shorelines of rivers, ponds, and lakes. The very low number of specimens collected or documented has lead to its being listed as extremely rare in Montana. In Wyoming, the construction of reservoirs has provided an unusual increase in potential habitat for this species (Rollins 1993). There is no basis for addressing potential threats to the species in Montana (Heidel 1994).

METHODS

Information collection and compilation for this Biological Assessment began formally in 1991 with the initiation of the Fish and Wildlife Coordination Act Report (CAR) for the Tongue River Dam Project and has continued to the present. Information collection methods included the review of existing literature, and contact with knowledgeable individuals.

The T&E species addressed in this document were selected from the September 1994 list of Threatened and Endangered Species - Montana. The candidate species were selected, on the basis of potential occurrence in the project area, from the Montana Animal and Plant Candidates for Listing Under the Endangered Species Act.

There was little available published literature (technical reports or other publications) pertaining specifically to the project area. Therefore, when available, information was cited for areas thought to contain analogous habitat types or conditions.

The Montana Natural Heritage Program provided a computer generated listing of T&E and candidate species documented in the project area. Additionally, they provided life history and distribution information for many of the species assessed.

All citations used in this Biological Assessment are included in LITERATURE CITED.

Contacts with knowledgeable individuals included discussions with landowners, personnel from USFWS, MDFWP, MDNRC, BLM, FS, DSL and mining companies at various dates from 1991 through 1995. All personal communications cited in this Biological Assessment were included in the text.

A further discussion of assessment and documentation efforts for the T&E species can be found in the CAR.

EFFECTS OF THE PROPOSED ACTION

As delineated in the Project Description section, both action alternatives involve a 4-foot raise of the spillway crest, as well as the institution of a number of fish and wildlife enhancement measures. Therefore, with some minor differences attributable to construction techniques, the effects on T&E and candidate species are judged to be identical. Major effects include the following:

(1) Approximately 541 acres of woody and herbaceous riparian wildlife habitat are estimated to be lost with construction of the project, largely through inundation with the raised reservoir pool.

(2) Approximately 139 acres of grassland and 25 acres of scrub forest wildlife habitats are estimated to be lost.

(3) Approximately 6.5 acres of existing wetland habitat may be lost if the existing dike at "pike pond" marsh fails as a result of new reservoir levels.

(4) No long term (i.e., beyond several years) adverse impacts to aquatic resources are anticipated, based on construction and operating scenarios provided for this analysis. However, shorter-term impacts (construction period and a few years afterwards) are expected to be rather severe due to reservoir drawdown and seasonally reduced streamflows below the dam during approximately a 2-year construction period.

Anticipated beneficial effects associated with the implementation of fish and wildlife habitat enhancement features are:

(1) Restoration of degraded riparian habitats

(2) Restoration/preservation of native short-grass prairie habitat

(3) Decrease in habitat fragmentation in the project area

(4) Provision of instream flows during critical periods

DIRECT AND INDIRECT IMPACTS OF PROPOSED ACTION

Threatened and Endangered Species

Bald Eagle

Potential adverse impacts

Impacts to the bald eagle include displacement during construction from the area immediately downstream from the dam. This area contains suitable roosting, hunting, and fishing sites. Displacement from this site would not be considered a significant impact to the species, due the amount of suitable habitat extending several miles downstream of the dam. However, if this upstream area provided the only open water during a cold-weather event, effects on the bald eagle would be greater. It is recognized that sufficient open water to attract waterfowl and allow fishing is a very important factor for eagles wintering in the area.

Accidental discharge of toxic chemicals or petroleum products into or near the waterway, if released in sufficient quantity, could cause direct mortalities of this species or indirectly impact them by reducing fish and waterfowl abundance.

If new aerial powerlines are required during construction or for subsequent dam operations, these lines could cause direct mortalities from eagles colliding with the lines or being electrocuted.

Increased vehicular activity during the construction period could result in a larger number of road killed big game. Bald eagles foraging on the increased carrion source would be potential victims of vehicular collision.

Short-term increases of turbidity in the river resulting from construction activities could reduce fishing success or opportunity for the eagles.

Increased traffic near the active nest 2.5 miles downstream of the dam during the late winter to mid-summer nesting fledging period could disturb the eagles and result in nest abandonment. The proximity of the nest to the county road greatly elevates the risk of disturbance from vehicular traffic. The nesting eagles do not appear to be overly disturbed by the existing (sparse) amount of vehicular usage of the road.

Potential beneficial impacts

Implementation of the enhancement measures designed to restore/construct wetlands, establish a riparian corridor, minimize habitat fragmentation, and establish and provide instream flows may result in increased numbers of prey species such as waterfowl, small game, and fish. Additionally, efforts to regenerate cottonwood stands along the river may result in additional roosting/nesting sites in the project area.

Peregrine Falcon

Potential adverse impacts

The limited occurrence of this species in the project area makes the chance of any detrimental impacts to the species remote. However, the discussions above for the bald eagle regarding, open water during the winter, threat of toxic spills, and danger from new powerlines apply for falcons that may migrate through the project area.

Potential beneficial impacts

Implementation of the enhancement measures as discussed above under the bald eagle may benefit the peregrine falcon to some extent. Expected benefits would derive from increased prey species numbers.

Piping Plover/Least Tern

These species are addressed in common due to similarity in habitat requirements and because neither have been documented in the project area. No adverse impact is anticipated for either species due to the historical paucity of suitable habitat in the project area. However, suitable to marginally suitable habitat may become available below the high water mark in the reservoir during the drawdown for construction. Use of these areas would not be expected unless high water levels or other environmental factors precluded these species from using more suitable areas in the Missouri, Milk, and Yellowstone drainages. If piping plovers or least terns establish nesting areas in the lowered pool area they may be displaced after refilling of the reservoir.

Pallid Sturgeon

Potential adverse impacts

Since pallid sturgeon are not known to occur in the project area, the potential for adverse impacts are low. Reduced river flows during the construction period may reduce the suitability of the habitat at the mouth of the river for this species. However, lack of suitable habitat does not appear to be a major limiting factor for pallid sturgeon in the vicinity of the project area. Any pallids affected by the reduced flows could retreat to the Yellowstone River where presumably suitable habitat is readily available.

Accidental discharge of toxic chemicals, including petroleum products, could adversely affect this species. A discharge of this type would have to be of great magnitude to have a perceptible impact nearly 190 miles downstream.

Potential beneficial impacts

The establishment and provision of adequate instream flows as part of the enhancement measures associated with the project could benefit the pallid sturgeon by making the existing habitat more attractive or opening up new areas previously thought unusable. Additionally, if a fish passage structure suitable for use by sturgeon is constructed at the T&Y Diversion Dam, additional habitat would become available.

Black-footed Ferret

Potential adverse impacts

Since the black-footed ferret is not believed to occur in the project area, the potential for adverse impacts to the species is remote. Any adverse impacts would be expected to be the result of project impacts on prairie dogs. One small, isolated, black-tailed prairie dog colony occurs on the east side of the reservoir near the mouth of an ephemeral stream. This colony is not of suitable size to support black-footed ferrets. The colony may be gradually affected by raised groundwater levels following refilling of the reservoir. It is anticipated that prairie dogs affected in this manner would likely relocate a short distance upgradient of their present location.

Potential beneficial impacts

The implementation of enhancement measures designed to restore and preserve native short-grass prairie ecosystems, including prairie dog colony complexes, may benefit the black-footed ferret if complexes of sufficient size to support ferrets can be preserved or established.

Category 1 Candidate Species

Mountain Plover

Potential adverse impacts

The potential for adverse impacts to this species is remote due to the apparent lack of suitable habitat in the project area.

Potential beneficial impacts

Implementation of enhancement measures designed to restore and preserve native short-grass prairie ecosystems may benefit this species to some degree. However, lack of historical records for this species in the project area may indicate that habitat factors such as topography and elevation do not meet the needs/preferences of this species.

Sturgeon Chub

Potential adverse impacts

The greatest potential for adverse impacts to the sturgeon chub would result from low flows during the construction period. However, the stream reach in which this species historically has been collected is perennially dewatered during the irrigation season. This situation is not expected to change appreciably during the construction phase of the project. The T&Y Irrigation Company holds and exercises the senior direct flow right on the river. It is reasonable to assume that it will continue to divert the allotted water during construction and virtually dewater the stream for some distance below the T&Y diversion dam.

Potential beneficial impacts

Benefits could accrue to this species from the implementation of enhancement measures which provide increased instream flows during critical periods or provide passage around those structures blocking fish migration. At present, it is not known what level of instream flow is needed to benefit this species. It is reasonable to assume, however, that provision of any level of flow in those perennially dewatered stream reaches would be an improvement over present conditions. The same reasoning may be applied to the issue of fish passage. Although it has not been documented that lack of habitat in the project area is a limiting factor for this species, it is reasonable to assume that allowing this species access to portions of the river with better flow conditions would be a benefit.

Sicklefin Chub

Due to the close association of the sicklefin chub and the sturgeon chub, the discussions of adverse and beneficial impacts above is applicable for this species.

Category 2 Candidate Species

In the discussions of category 2 species where no adverse impact is predicted based on apparent non-occurrence of the species in the project area, the prediction of potential beneficial impacts is based on the establishment or expansion of suitable habitat.

Spotted Bat

Potential adverse impacts

This species has not been documented in the project area, and the project will not disturb roosting areas such as caves and crevices in cliffs. Therefore, the potential for adverse impacts to this species is judged to be remote.

Potential beneficial impacts

The likelihood that benefits will accrue to this species as of the construction or enhancement phases of the project is also judged to be remote.

Small-footed Myotis

Potential adverse impacts

This species could be affected to a small degree by the gradual loss of the riparian gallery forest at the head of the reservoir. The small-footed bat is known to roost under loose bark and could experience a loss of roosting habitat. This impact is not be expected to be significant since the species also roosts under boulders, in crevices etc. and the loss of roosting trees would be a slow process, somewhat mitigated by regeneration at higher elevation.

Potential beneficial impacts

Beneficial impacts for this species could result from mitigation or enhancement measures designed to aid in the regeneration of cottonwood forests along the Tongue River, and restoration or creation of wetland areas. Regeneration of cottonwoods may result in more or improved roosting habitat in the project area. Wetland projects may provide an increased food supply for this species.

Long-eared Myotis

The discussion of adverse and beneficial impacts under the small-footed myotis are applicable for this species.

Long-legged Myotis

The discussion of adverse and beneficial impacts under the small-footed myotis are applicable for this species except that this species is probably more numerous in the project area.

Pale Townsend's Big-eared Bat

The discussion of adverse and beneficial impacts under the small-footed myotis are applicable to this species.

Swift Fox

Potential adverse impacts

No adverse impacts are predicted for this species as a result of the project due in part to the rarity of the species and the types of project impact.

Potential beneficial impacts

Implementation of enhancement measures designed to restore or preserve native short-grass prairie habitat in the project area could provide more habitat for this species. However, the overall benefit is judged to be small since the amount of prairie habitat that may be preserved or restored is minute compared to the vast areas profoundly altered by modern agricultural practices.

Northern Goshawk

Potential adverse impacts

No adverse impacts are predicted for this species since no coniferous forests will be impacted.

Potential beneficial impacts

This species may experience limited benefits arising from expanded populations of forage species associated with short-grass prairie initiatives.

Baird's Sparrow

Potential adverse impacts

No adverse impacts are predicted for this species since it has not been documented in the project area and suitable habitat is limited.

Potential beneficial impacts

Suitable habitat for the Baird's sparrow may be expanded somewhat in the project area with the implementation of the short-grass prairie enhancement measures. Changes in grazing rotation and stocking numbers associated with the enhancement measures may result in larger areas of suitable habitat. Whether there are other factors limiting use of the project area by this species is unknown.

Western Burrowing Owl

Potential adverse impacts

The most significant adverse impact to this species would result from impacts to prairie dog colonies in the project area. As discussed under the black-footed ferret heading, the only prairie dog colony potentially affected by the construction phase of the project is a small colony on the east side of the reservoir. It is expected that if the new reservoir pool affects this colony it would relocate upgradient a short distance resulting in no loss of this habitat type.

Potential beneficial impacts

Short-grass prairie initiatives including prairie dog colony management/protection may benefit this species by expanding the suitable habitat for the species in the project area.

Ferruginous Hawk

Potential adverse impacts

Only minor adverse impacts are predicted for this species. The loss of a small amount of marginally suitable habitat in the reservoir vicinity will be offset by mitigation and enhancement measures.

Potential beneficial impacts

The ferruginous hawk may benefit from the implementation of short-grass prairie initiatives which may increase prey populations.

Black Tern

Potential adverse impacts

No adverse impacts of a significant nature are predicted for this species. Historic operations of the reservoir have not been conducive to black tern nesting. If the species uses the reservoir at other times, that use may be somewhat impacted during the drawdown for construction. However, any such use is light indicating the reservoir is not an important area for the species.

Potential beneficial impacts

The restoration or creation of wetlands in the project area may present improved nesting opportunities for the black tern.

Short-horned Lizard

Potential adverse impacts

This species has been documented in the reservoir area of the project. Road building, aggregate collection, and other associated construction activities combined with the new reservoir pool will undoubtedly reduce available habitat and cause incidental mortality for this species. These effects are not judged to be significant to survival of the species, given the large area of suitable habitat in the project area.

Potential beneficial impacts

No potential benefits are predicted for this species.

Northern Sage Brush Lizard

The discussion of impacts for the short-horned lizard is applicable to this species, with the possible exception that this species may be better able to avoid incidental mortality due to its greater mobility.

Blue Sucker
Western Silvery Minnow
Plains Minnow
Flathead Chub
Paddlefish

The discussion of impacts for the category 1 sturgeon chub is applicable to these species. Although there is some differentiation in habitat usage/selection, the basic impacts and benefits from the project would accrue to these species in a like manner.

Persistentsepal Yellowcress

Potential adverse impacts

This species has not been documented in the reservoir area where the most of the ground-disturbing activates associated with this project will occur. It has, however, been documented in the lower basin, where it may occur in riparian areas in association with noxious weeds. The implementation of enhancement measures to control noxious weeds through chemical application may affect this species.

Potential beneficial impacts

This species may benefit from the implementation of enhancement measures designed to limit livestock grazing in riparian areas. Additionally, the creation of new wetlands may provide suitable habitat for colonization by this species.

CUMULATIVE IMPACTS

The most apparent cumulative impacts for this project would be associated with the proposed construction of the Tongue River Railroad Company (TRRC) extension line from Decker to Ashland and on-going coal strip-mining operations in the reservoir area. Depending on the route selected for the line, as well as timing of construction activities, cumulative impacts of a potentially significant nature could arise from these two projects. If TRRC's preferred alternative is selected and construction of the two projects proceeds concurrently, the combination of the activities could potentially preclude use of the upper reaches of the river below the dam by bald eagles or peregrine falcons. Other cumulative impacts could result from transportation of construction materials for the two projects.

The combination of the construction phase of the Tongue River Basin Project and on-going mining operations will produce short-term cumulative impacts resulting from increased noise levels and sagebrush/prairie habitat destruction. These impacts are not judged to be significant in the long-term.

COORDINATION MEASURES

The following measures are designed to eliminate or lessen the severity of adverse impacts to the listed species and will be included as commitments in the Record of Decision for the Project.

<u>Threatened and Endangered Species</u>

Bald Eagle

(1) At a minimum, second option planning as delineated in the "**Montana Bald Eagle Management Plan, July 1994**" (Management Plan) will be applied for the nest site 2.5 miles downstream of the dam and any others identified in the project area. This approach defines 3 concentric nest-site management zones around the nest. For each zone there is a set of guidelines for managing activities in that zone, with restrictions generally decreasing as distance from the nest increases. Under this planning scenario the outer-most zone extends 2.5 miles from the nest.

If as a result of final design considerations, construction activities are proposed which would abbrogate guidelines set forth in the Management Plan, third or fourth option planning would be conducted to determine if the proposed activities would be allowable. These planning options involve a researched, site-specific approach to define which specific areas are being used by the eagles.

The following measures will be applied to augment or supplement the guidelines contained in the Management Plan.

(2) Prohibit usage of the county road adjacent to the nest site for project-related traffic during the February 1 to August 15 period for each year of construction. Project-related traffic includes, but is not limited to; trucks, heavy equipment, and commuting workers.

(3) Monitor the project area, with emphasis on the upper river, for nesting bald eagles or adult eagles exhibiting nesting behavior, each spring beginning in 1995 and continuing through the completion of dam rehabilitation activities.

(4) Monitor upper project area (reservoir and approximately 5 miles downstream) for bald eagle presence and use during fall, winter and spring of each construction season. Ice conditions in the river should be monitored during low flow periods to ensure that sufficient open water exists to attract waterfowl. If it does not, flows in the river would be increased to accomplish this. If storage water is not available for this purpose the project sponsors will contact USFWS to determine what other measures may be needed to minimize or eliminate impacts to the bald eagle.

(5) Post and enforce vehicle speed limits in the reservoir area including the downstream construction area to lessen the risk of vehicle collisions with big game. The combination of less carrion and lower speeds will reduce the risk of bald eagle/vehicle collisions.

(6) Employ high construction standards and rigid safety precautions to minimize the potential for an accidental spill or discharge of any chemical or petroleum product. Additionally, spill control plans/measures will be in place prior to the beginning of construction.

Peregrine Falcon

(1) Items 4, 5, and 6 described under bald eagle are applicable to the peregrine falcon.

(2) The project area will be surveyed for peregrine falcons during the spring, summer and fall of 1995 prior to the beginning of construction activities. If peregrines are documented in the project area, a determination will be made at that time regarding potential impacts of specific construction activities and the need for additional coordination measures.

Piping Plover and Least Tern

(1) The surveys conducted in 1991 in conjunction with preparation of the CAR are considered coordination measures to reduce potential adverse impacts to piping plovers and least terns. The reservoir area will be surveyed in the spring and summer of 1995, and during the construction drawdown to determine if either of these species has begun to use the area. If nesting birds are located during these subsequent surveys, consultation with USFWS will immediately be re-initiated.

Pallid Sturgeon

(1) The surveys conducted in 1991 in conjunction with preparation of the CAR for this project in 1991 are considered to be coordination measures to reduce potential adverse impact to the pallid sturgeon. If other evidence of the existence of this species in the project area, such as an incidental catch by a fisherman or collection by MDFWP during electroshocking or netting arises, consultation with USFWS will immediately be re-initiated.

Black-footed Ferret

(1) A ferret survey will be conducted prior to implementing any enhancement measures that will negatively affect prairie dog towns exceeding the 80-acre threshold delineated in the previously mentioned 1989 survey guidelines.

(2) If ferrets are discovered, consultation with USFWS will be immediately re-initiated.

Category 1 & 2 Candidate Species

(1) Items 5 and 6 described under bald eagle apply to candidate species.

(2) Information will be collected on candidate species in the project area in conjunction with the implementation of the enhancement measures and other project activities to aid in the understanding of the ecology of these species and determine how future project operations may affect these species.

DETERMINATION OF EFFECTS

Bald Eagle

Based upon analysis of the proposed action, the current and potential status of the species in the project area, other land use activities in the area and with the incorporation of the coordination measures recommended in this assessment, a determination of no adverse effect is concluded for the bald eagle.

Peregrine Falcon

Based upon analysis of the proposed action, the current and potential status of the species in the project area, other land use activities in the area and with the incorporation of the coordination measures recommended in this assessment, a determination of no adverse effect is concluded for the peregrine falcon.

Piping Plover and Least Tern

Based upon analysis of the proposed action, the current and potential status of the species in the project area, other land use activities in the area and with the incorporation of the coordination measures recommended in this assessment, a determination of no adverse effect is concluded for the piping plover or least tern.

Pallid Sturgeon

Based upon analysis of the proposed action, the current and potential status of the species in the project area, other land use activities in the area and with the incorporation of the coordination measures recommended in this assessment, a determination of no adverse effect is concluded for the pallid sturgeon.

Black-footed Ferret

Based upon analysis of the proposed action, the current and potential status of the species in the project area, other land use activities in the area and with the incorporation of the coordination measures recommended in this assessment, a determination of no adverse effect is concluded for the black-footed ferret.

Category 1&2 Candidate Species

Based upon analysis of the proposed action, the current and potential status of the species in the project area, other land use activities in the area and with the incorporation of the coordination measures recommended in this assessment, a determination of no adverse effect is concluded for the category 1&2 candidate species.

REFERENCES

Backes, K.M. 1993. Fish Population Investigations for the Tongue River, 1993. Montana Department of Fish, Wildlife, and Parks, Miles City.

Bailey, R.M., and M.O. Allum. 1962. Fishes of South Dakota. Miscellaneous Publication 119, Museum of Zoology, University of Michigan, Ann Arbor.

Bergeron, D., C. Jones, D.L. Genter, and D. Sullivan. 1992. P.D. Skaar's Montana Bird Distribution, Fourth Edition. Special Publication No. 2. Montana Natural Heritage Program, Helena. 116 pp.

Cutter, W.L. 1958a. Denning of the swift fox in northern Texas. J. Mammal., 39:527-532

Decker Coal Company. 1990. Annual Wildlife Report. Unpublished.

Dobkin, D.S. 1992. Neotropical Migrant Landbirds in the Northern Rockies and Great Plains. U.S.D.A. Forest Service Northern Region. Publication No. RI-93-34. Missoula, Montana.

Elser, A.A., R.C. McFarland, D. Schurchr. 1977. The Effect of Altered Streamflow on Fish of the Yellowstone and Tongue Rivers, Montana. Yellowstone Impact Study Technical Report #8. Montana Department of Natural Resources and Conservation, Helena.

Elser, A.A., M.W. Gorges, and L.M. Morris. 1980. Distribution of Fishes in Southeastern Montana. Montana Department of Fish, Wildlife and Parks; U.S. Department of the Interior, Bureau of Land Management.

FaunaWest Wildlife Consultants. 1991. An Ecological and Taxonomic Review of the Swift Fox (Vulpes velox) with special reference to Montana. Report prepared for the Montana Department of Fish, Wildlife, and Parks, Montana State University Campus, Bozeman.

Fitzgerald, J.P., R.R. Loy, and M. Cameron. 1983. Status of the swift fox on Pawnee National Grassland, Colorado. Unpublished manuscript. 21 pp.

Gardner, W.M. 1995. Population Status of Blue Sucker in Montana. Unpublished paper presented at the 1995 Montana Chapter of the American Fisheries Society annual meeting. Montana Department of Fish, Wildlife, and Parks, Lewistown.

Genter, D.L. 1989. Townsend's big-eared bat. *Plecotus Townsendii.* In: T.W. Clark, A.H. Harvey, R.D. Dorn, D.L. Genter, and C. Groves (eds). Rare, sensitive, and threatened species of the Greater Yellowstone Ecosystem. N. Rockies Conservation Coop., Montana Natural Heritage Program, The Nature Conservancy, and Mountain W. Envir. Serv. 153 pp.

Genter D.L. and L.H. Metzgar. 1985. Survey of the bat species and their habitat use in Grand Teton National Park. Pp. 65-69. In: University of Wyoming-National Park Service Research Center, Annual Report 9.

Grisek, G. 1995. History of the Sicklefin Chub in Montana. Unpublished student paper presented at the 1995 Montana Chapter of the American Fisheries Society annual meeting. Montana State University, Bozeman.

Guyer, C. 1978. Comparative Ecology of the short-horned lizard (*Phrynosoma douglassi) and the sagebrush lizard (Sceloporus graciosus). MS Thesis, Idaho State University, Pocatello. 130 pp.*

Heidel, B.L. 1994. Sensitive Plant Species Survey Garfield and McCone Counties, Montana. Unpublished report to the Bureau of Land Management. Montana Natural Heritage Program, Helena. 58 pp. plus appendices.

Hillman, C.N. and J.C. Sharps. 1978. Return of the swift fox to northern Great Plains. Proc. of the South Dakota Acad. of Sci. 57:154-162

Hines , T.D. 1980. An ecological study of *Vulpes velox* in Nebraska. MS thesis. University of Nebraska, Lincoln. 103 pp.

Hoffman, R.S. and D.L. Pattie. 1968. A guide to Montana mammals: identification, habitat, distribution, and abundance. University of Montana Printing Service, 133 pp.

Hoffmann, R.S., D.L. Pattie, and J.F. Bell. 1969. The distribution of some mammals in Montana. II. Bats. J. Mammal. 50(4):737-741.

Humphrey, R.S. and T.H. Kunz. 1976. Ecology of a Pleistocene relict, the western big-eared bat (*Plecotus townsendii)* in the southern Great Plains. J. Mammal. 57(3):470-494.

Interstate Commerce Commission. 1992. Draft environmental impact statement, Finance Docket No. 30186 (Sub-No.2), Tongue River Railroad Company - construction and operation of an additional rail line from Ashland to Decker, Montana. Interstate Commerce Commission, Section of Energy and Environment, Washington, D.C.

Jones, J.K. Jr. et al. 1973. Notes on the distribution and natural history of bats in southeastern Montana. Occas. Pap. Mus. Texas Tech. Univ. 15:1-11

Kilgore, D.L. 1969. An ecological study of the swift fox (*Vulpes velox*) in the Oklahoma panhandle. Amer. Midl. Nat., 81:512-534.

Knowles, C.J., C.J. Stoner, and S.P. Gieb. 1982. Selective use of black-tailed prairie dog towns by mountain plovers. Condor, 84:71-74.

Martin, P.R., K. DuBoise, and H.B. Youmans. 1981. Terrestrial Wildlife Inventory in Selected Coal Areas, Powder River Resources Area. Final Report. Montana Department Fish, Wildlife and Parks.

Navo. K.W., J.A. Gore, and G.T. Skiba. 1992. Observations on the spotted bat, *Euderma maculatum*, in northwestern Colorado. J. Mammal. 73:547-551.

Olson, S.L. 1984. Density and distribution, nest site selection, and activity of the Mountain Plover on the Charles M. Russell National Wildlife Refuge. M.S. Thesis, University of Montana, Missoula.

Olson-Edge, S.L. and W.D. Edge. 1987. Density and distribution of the Mountain Plover on the Charles M. Russell National Wildlife Refuge. Prairie Nat. 19:233-238.

Pflieger, W.L. 1975. The Fishes of Missouri. Missouri Department of Conservation, Jefferson City.

Phillips, R.L., A.H. Wheeler, J.M. Lockhart, T.P. McEneaney and N.C. Forrester. 1990. Nesting ecology of golden eagles and other raptors in southeastern Montana and northern Wyoming. U.S. Fish and Wildlife Service, Fish and Wildlife Technical Report 26, Washington, D.C.

Powell, G.L. and A.P. Russell. 1985. Growth and sexual size dimorphism in Alberta populations of the eastern short-horned lizard (*Phrynosoma douglasii brevirostre)* Can. J. Zool. 63:139-154.

Schmidly, D.J. 1991. The bats of Texas. Texas A&M University Press, College Station. 188 pp.

Stewart, D.D. 1981. The Biology of the Sturgeon Chub (*Hybopsis gelida Girard*) in Wyoming. Unpublished M.S. Thesis, University of Wyoming, Laramie.

Thomas, D.W. and S.D. West. 1991. Forest age associations of bats in the southern Washington Cascade and Oregon Coast Ranges. Pp. 295-303 In: Ruggerio, L.F., K.B. Aubry, A.B. Carey and M.H. Huff (tech. coord.) wildlife and vegetation of unmanaged Douglas-fir forests. USDA Forest Service, Pacific Northwest Research Station, Gen. tech Report PNW-GTR-285. 533 pp.

Thompson, L.S. 1982. Distribution of Montana amphibians, reptiles, and mammals. Montana Audubon Council. 24 pp.

Twente, J.W. Jr. 1955. Some aspects of habitat selection and other behavior of cavern-dwelling bats. Ecology 36(4):706-732.

U.S. Fish and Wildlife Service. 1989. A Report on the Pallid Sturgeon

Wai-Ping, V. and M.B. Fenton. 1989. Ecology of the spotted bat (*Euderma maculatum)* roosting and foraging. J. Mammal. 70:617-622

Watson, J.H. and P.A. Stewart. 1991. Lower Yellowstone River Pallid Sturgeon Study. Montana Department of Fish, Wildlife and Parks. Miles City.

Werdon, S.J. 1992. Population status and Characteristics of *Macrhybopsis gelida, Platygobio gracilis and Rhinichthys cataractae.* Unpublished M.S. Thesis, South Dakota State University, Brookings.

Wittenhagen, K.W. 1992. 1992 Final Report on the Ferruginous Hawk in Southeastern Montana. Bureau of Land Management, Powder River and Big Dry Resource Areas, Miles City, Montana.

APPENDIX C

ENHANCEMENT FEATURE PLAN

TONGUE RIVER BASIN PROJECT
ENHANCEMENT FEATURE PLAN
Prepared by
Mark Albers
United States Bureau of Reclamation
October 1994

I. INTRODUCTION

The Northern Cheyenne Indian Reserved Water Rights Settlement Act of 1992 allocated $4.6 million for enhancement of fish and wildlife habitat in the Tongue River Basin. The funds are provided pursuant to P.L. 89-72, with a cost-share arrangement of $3.5 million in federal funds and $1.1 million in state funds. The enhancement features discussed herein apply to either action alternative being considered in the Tongue River Basin Project EIS and may be implemented regardless of which alternative ultimately is selected.

Enhancement planning for the Tongue River Basin Project has been carried out in conjunction with and parallel to other project planning, project impact mitigation planning, and environmental impact assessment and statement preparation processes. The enhancement planning activity focusses on the improvement of aquatic and terrestrial habitat in the Tongue River Basin. For the purpose of disclosure in the environmental impact statement, this Enhancement Feature Plan presents an array of alternative enhancement features. For the purpose of continuing the planning process, the plan presents a set of alternatives that can be selected from for final design.

II. ENHANCEMENT PLANNING PROCESS

The enhancement planning process was initiated formally with the formation of the Interagency Enhancement Team (Team) and the subsequent compilation of a list of potential enhancement features, concepts and ideas for projects. The Team is comprised of the Agencies, Montana Department of Fish, Wildlife and Parks, United States Fish and Wildlife Service, and the Bureau of Indian Affairs. A list of the 17 enhancement features currently under consideration is included in **Table C-1**. Final selection of site-specific projects would be made by the project sponsors with input from the Team.

The enhancement features in this plan are presented in a programmatic fashion to illustrate the types of projects under consideration. As planning for the enhancement features continues, site-specific projects will be identified and evaluated under the appropriate NEPA/MEPA compliance process.

The enhancement planning process recognized the need for cooperative, educational, and other programs that are not site-specific to allow the Agencies the latitude to select projects that are the most beneficial for habitat enhancement as they become evident. For example, as a particular piece of land with high habitat value became available for acquisition under purchase or easement, a site-specific project would be assembled.

TABLE C-1
POTENTIAL ENHANCEMENT FEATURES

1. Acquire lands of high habitat value through purchase or easement to enhance or protect those values.

2. Develop and enhance existing wetland sites.

3. Develop stock pond/small wetlands.

4. Construct wetlands.

5. Enhance aquatic habitat.

6. Enhance riparian habitat.

7. Enhance upland habitat by providing water, shelter belts, dense nesting cover, food plots and sediment control.

8. Enhance instream flows by: 1) a water rights acquisition program; 2) monitoring and enforcement of diversion; 3) a streamflow gaging program.

9. Provide fish passage around diversion dams.

10. Screen inlet structures at diversions.

11. Initiate livestock management and exclusion systems.

12. Enhance the Tongue River Reservoir perimeter.

13. Install bird nesting structures along the Tongue River Corridor and Reservoir Shoreline.

14. Remove trash and car bodies from selected sites.

15. Develop weed control programs.

16. Develop cooperative programs with private landowners and agencies and develop habitat conservation education program as part of an overall ecosystem management planning activity.

17. Provide short grass/native prairie ecosystem management/enhancement on the Northern Cheyenne Reservation including prairie dog re-establishment in plague-affected areas on the reservation, and a bison restoration program.

III. ENHANCEMENT FEATURE DESCRIPTIONS

Listed below are the types of projects or programs currently under consideration as enhancement features. Site-specific enhancement measures may include aspects of one or many of the features listed.

Land Acquisition. Lands with high habitat values or the potential for high values would be identified and acquired through purchase or easement from willing sellers. The Agencies would establish a management plan embodying as many of the enhancement features listed herein as is feasible upon acquisition of individual properties. After the development of the features and the establishment of protective covenants or easements, the properties would be sold or traded to private individuals. Any funds derived from the sale of properties would be used for similar acquisitions in the Tongue River Basin.

Wetland Development. Wetland enhancement may include developing existing wetland sites, constructing new wetlands, and developing stock watering/small wetland sites. In all cases, wetland enhancement relates to one or more water sources and in some cases involves water development and/or water source development.

Water development is distinguished from water source development by targeting the management of precipitation, runoff, and retention of existing water. Water source development entails the improvement of flows and use systems for springs and shallow aquifers already in use as part of habitat enhancement.

Water development is a feature of overall habitat enhancement that would involve constructing new impoundments or embankments to catch or divert runoff, or repairing or increasing the capacity of existing impoundments. The feature may be used in conjunction with a "sediment trap" and could be applied to both upland and wetland sites. An early stage of design must verify that sufficient runoff would be provided by the watershed, that soil and geotechnical conditions were suitable for proposed construction, and that overall channel hydraulics were consistent with the proposed structures and their integrity. In the case of developing or increasing the capacity of wetlands or existing impoundments, the design approach can be focused on the feasibility of enhancing the existing conditions and the impacts of such enhancement. Repairing existing impoundments is a straightforward activity of designing the procedures and materials for construction, and evaluating the impacts of retaining runoff and enhancing habitat.

Water source development is a feature of overall habitat enhancement that involves increasing flows and/or improving the management of flows from existing water sources. The capability of the water source must be carefully estimated and evaluated in the context of requirements for sustaining the proposed habitat enhancement. Following the capability evaluation, initial engineering design of water source development and impacts assessment would begin.

Water-related wetland enhancement designs for streams and impoundments are intended to divert surface water to form new wetlands. Designs may also increase the impoundment potential of an existing wetland area, develop and protect stockwatering/small wetland areas, rehabilitate and protect existing wetland features, and impound seepage.

The enhancement potential of this type of marsh is excellent. Waterfowl habitat limited by extremes in pool elevation results in few submergent and emergent aquatic plants becoming established. If portions of

a reservoir are partitioned off with dikes and structural controls emplaced, water levels could be stabilized in the marshes allowing aquatic vegetation to become established.

Other features associated with wetlands enhancement include livestock exclusion and management, development of additional breeding-pair ponds, predation-management measures, establishment of appropriate vegetation types, removal of target vegetation, erosion control, and nesting-structure development.

Aquatic Habitat Enhancement. While the success of aquatic habitat enhancement is dependent on many associated structural, vegetative, and management activities, individual features deal with improving conditions for the survival of target fish species. Providing spawning areas, rehabilitating downstream stock ponds and reservoirs, screening irrigation inlets at diversions, and constructing fish passages at diversion dams are specific features potentially implementable as enhancements. Clearly, in-stream flow maintenance, livestock exclusion and management, establishing and protecting riparian habitat, sediment traps, and erosion control plans play a critical part in the overall success of enhancement activities and the quality of the aquatic habitat. All such features would be carefully considered when preparing aquatic enhancement plans.

Riparian Habitat Enhancement. Riparian habitat enhancement must focus on areas with identifiable, riparian wildlife management potential and supplement the mitigation plan. Riparian habitat enhancement features would focus on the establishment of woody and herbaceous growth at locations with appropriate potential.

Trees such as cottonwood, green ash, and boxelder and shrubs such as woods rose, buffalo berry, and chokecherry would be planted in areas around the new high water mark of the reservoir. Cottonwood cuttings may also be planted in adjacent overbank. Areas would be fenced or individual trees protected during seedling establishment. As with other habitat enhancement features, there are numerous design activities that may play a critical part in the success of riparian enhancement. Livestock exclusion and management, human exclusion, timing and duration of pool elevation, and the operation/maintenance/replacement plans would impact how the overall feature plan achieved its potential.

Upland Habitat Enhancement. Upland habitat enhancement features can use a water source as a focal point, can concentrate on vegetative features that rely only on precipitation and runoff for success, or may use both. While upland habitat is the target of enhancement feature plans, the wildlife type or mix of wildlife that rely on the habitat influences the composition of proposed food plots, the mix of shelter belt and dense nesting cover establishment, range management, and water source rehabilitation. DFWP's *Upland Game Bird Habitat Enhancement Program Guidelines* (Department of Fish, Wildlife and Parks 1994a) provides the fundamentals for establishing shelter belts, range management, food plots, temporary winter cover, wetland restoration and nesting cover. These guidelines serve as a basis for assessing upland wildlife management potential, enhancement needs and the components of a feature plan.

Sediment traps usually are not considered the main feature for a site but they may assist in promoting overall habitat quality. Even sediment traps themselves usually are not designed without associated soil loss reduction/conservation programs. Sediment traps are likely to be located in upland areas and as such may be a design consideration associated with an upland water source.

In-stream Flow Enhancement. In-stream flow enhancement approaches include a water rights acquisition program, the establishment of a water diversion monitoring program and enforcement activity, and the implementation of a streamflow gauging program. The three potential features would be explored as to cost-effectiveness, feasibility, and implementability in subsequent stages of the enhancement planning process.

Livestock Management and Exclusion. Livestock management and exclusion may be the primary plan components for an area or part of a more complex habitat enhancement feature. In either case, the management and exclusion of livestock is most likely targeted at promoting improved vegetative condition and residual cover, restricting or controlling access during periods critical to vegetative growth and/or wildlife nesting/rearing use, promoting use of an area, and protecting an area from erosion, trailing, and streambank destruction.

Installation of Bird-Nesting Structures. Nesting structures for woodducks, raptors, and neotropical migrants may be considered as potential enhancement features. Such structures could be strategically located in areas identified by wildlife biologists in a manner that enhances use for a desirable species, enhances wildlife viewing opportunities, and at the same time protects the species from predation.

Trash Removal From Specified Sites. Enhancement of riparian habitat, water quality, aesthetics, and safety could result from the removal of vehicle bodies, farm equipment, discarded fencing, inert rubble and other solid waste deposited in or adjacent to a portion of the Tongue River channel.

Develop Weed Control Programs. As habitat enhancement feature plans proceeded toward final design, weed control measures to prevent, control or eliminate noxious or invader species would be evaluated and implemented as appropriate.

Develop Cooperative Programs. Cooperative and educational programs that are not area- or feature-specific would be included in the overall enhancement plan. Programs would include establishing cooperative agreements and easements with landowners and involved agencies, developing habitat and conservation education programs, and developing management education for livestock, range, and land treatment. An overall ecosystem management plan would be implemented when the needs and emphasis of each program were clearly defined.

Short Grass/Native Prairie Management/Enhancement. The ecological importance of native prairie ecosystems is recognized throughout the Tongue River Basin. This feature is comprised of two main programs designed to enhance the habitat values of the short grass prairie ecosystem. A prairie dog re-establishment program would be designed to repopulate selected areas of the Northern Cheyenne Reservation where bubonic plague has seriously reduced prairie dog numbers. The intent of the program would be to recover the habitat values associated with prairie dog towns and complexes, thereby benefitting the many species associated with or dependent upon these habitat values. A bison restoration program would be designed to replace cattle grazing on selected areas of the Reservation. The intent of the program would be to reduce grazing impacts, gain more efficient forage utilization, and reduce riparian zone impacts associated with cattle grazing.

APPENDIX D

AIR QUALITY STANDARDS

AIR QUALITY STANDARDS

Table D-1 lists the Montana and federal ambient air quality standards. **Table D-2** lists the federal PSD Class I, II, and Class III increments for sulfur dioxide, TSP, and nitrogen dioxide.

TABLE D-1
Ambient Air Quality Standards

POLLUTANT	AVERAGING TIME	MONTANA STANDARD	FEDERAL PRIMARY STANDARD	FEDERAL SECONDARY
PM-10 Suspended Particulates	Annual 24-Hour	50 ug/m³ 150 ug/m³*	50 ug/m³ 150 ug/m³*	--- ---
Sulfur Dioxide	Annual 24-Hour 1-Hour 3-Hour	0.02 ppm 0.10 ppm* 0.50 ppm** ---	0.03 ppm 0.14 ppm* --- ---	--- --- --- 0.5 ppm*
Carbon Monoxide	8-Hour 1-Hour	9 ppm* 23 ppm*	9 ppm* 35 ppm*	9 ppm* ---
Nitrogen Dioxide	Annual 1-Hour	0.05 ppm 0.30 ppm*	0.05 ppm ---	0.05 ppm ---
Photochemical Oxidants (ozone)	1-Hour	0.10 ppm*	0.12 ppm*	0.12 ppm*
Lead	90-Day Quarter	1.5 ug/m³ ---	--- 1.5 ug/m³	--- ---
Hydrogen Sulfide	1 Hour	0.05 ppm*	---	---
Settled Particulate (Dustfall)	30-Day	10 gm/m²	---	---
Visibility	Annual	$3x10^{-5}$ per meter part scattering***	---	---

Source: Montana Air Quality Bureau 1991.

ug/m³ = Micrograms pollutant per cubic meter of sampled air.
ppm = Parts pollutant per million parts of sampled air.
* Not to be exceeded more than an average of once per year, averaged over 3 years.
** Not to be exceeded more than 18 times per year.
*** Applies to PSD mandatory Class I area.

TABLE D-2
Federal Prevention of Significant Deterioration
Allowable Increments

Micrograms Per Cubic Meter	I	II	III	Not To Exceed
Particulates				
Annual Geo. Mean	5	19	37	75
M1ximum 24-Hour	10	37	75	150
Sulfur Dioxide				
Annual Arith. Mean	2	20	40	80
Maximum 24-Hour	5	91	182	365
Maximum 3-Hour	25	512	700	1300
Nitrogen Dioxide				
Annual Arith. Mean	2.5	25	50	94

Source: Montana Air Quality Bureau 1993.

APPENDIX E

HYDROLOGIC DATA

HYDROLOGIC DATA

Spillway Design Flood Selection

The design level probable maximum flood (PMF) for the Tongue River Dam has been determined to be 382,000 cfs (Harza Engineering Company 1983). Alternatives for repairing and enlarging the dam and spillway to pass the full PMF are cost-prohibitive, with construction costs estimated to be $135 million (Montana Department of Natural Resources and Conservation 1985). In recent years, criteria and guidlelines have been developed (U.S. Bureau of Reclamation 1989) to assist with the selection of a spillway design flood (SDF). Application of these criteria and guidelines can demonstrate that a design flood less than the full PMF may be justified in certain cases. Reclamation applied these procedures to assess the situation for the Tongue River Dam emergency spillway (U.S. Bureau of Reclamation 1989a). Reclamation concluded that rehabilitation of the existing spillway to the original design capacity and installation of an early warning system would be adequate to meet federal dam safety standards and guidelines. Final adoption of the Reclamation findings may, however, be modified to take into account elements of the state dam safety law as well as more conservative approaches to the guidelines and criteria involving warning time.

Warning time was based on a number of factors as follows:

1. Evacuation routes out of the canyon for the first 12 miles below the dam are limited. The first all-weather road exiting laterally from the canyon is at Four Mile Creek, located about 12.5 river miles downstream of the dam. Given the lack of evacuation routes out of the canyon, the need for adequate warning time is particularly critical in this reach.

2. The remote location of the Tongue River Dam is such that a conservative warning time is needed to carry out the evacuation notice.

3. DNRC and State Disaster and Emergency Services (DES) officials have indicated that, as a rule of thumb, a minimum warning time of approximately 4 hours is required to successfully evacuate populations where the downstream hazard area contains more than 20 residences.

4. Residences below the dam with less than 4 hours warning time are sparsely distributed and will require special notification procedures during high water in order to successfully implement an evacuation plan. Communities below the dam, such as Birney Village, require special attention due to potential language barriers, especially among some elderly Northern Cheyenne tribal members that reside in these communities.

Evaluation

A total of five flood events, ranging from 60,000 cfs to 382,000 cfs (full PMF), were analyzed as the spillway design flood. The discharge equal to 60,000 cfs is about 16 percent of the PMF and represents the original spillway design flood (Harlan Miller Tait Association 1985). Intermediate floods of 100,000 cubic feet per second (cfs), 150,000 cfs, and 191,000 cfs were also investigated. The reservoir has a relatively small effect in attenuating the flood peaks associated with events of these magnitudes. Each loading was performed using a spillway configuration that would prevent an overtopping failure of the earthen dam embankment. Each

of the five floods were routed through the reservoir and downstream approximately 34 river miles to the community of Birney using the National Weather Service computer program DAMBRK (Fread 1988). Results are shown in **Table E-1**.

TABLE E-1
Results of Hydrologic Loadings on Downstream Incremental Population at Risk (PAR)
Tongue River Dam to Birney

Spillway Design Flood Discharge (cfs)	Approximate Percent of PMF	Incremental PAR Relative to Full PMF Design [1]
60,000	16	12
100,000	26	0
190,000	39	0
191,000	50	0
382,000	100	0

Note: [1] Each residence is assigned four-person occupancy in estimating population at risk (PAR) (U.S. Bureau of Reclamation 1989).
Source: Department of Natural Resources and Conservation 1990.

The increments of dam-related population at risk PAR shown in **Table E-1** (column 3) are essentially the same for natural loadings (i.e., no dam) and represent the opportunity cost of not providing a particular level of spillway capacity, relative to the full PMF. Results in **Table E-1** focus on the 34-mile reach of the Tongue River from the dam to Birney.

Preliminary selection of the SDF primarily was based on two concepts. The first concept involves PAR given various hydrologic loading conditions. The second concept integrates warning time with PAR to establish a finite location downstream of the dam beyond where it can be assumed that people can be safely evacuated.

Under the DAMBRK program analysis, floods of 100,000 cfs or greater resulted in no increase for incremental population at risk between the dam and Birney. A SDF of 60,000 cfs, however, could result in the inundation of several dwellings at higher flood flows. A SDF of 60,000 cfs may not provide a sufficient factor of safety to prevent dam-related inundation to the identified population at risk from the dam to Birney. SDF studies by DNRC and Reclamation indicate that a defensible case can be made to select a SDF less than the full PMF. Therefore, the Agencies have selected a SDF of 100,000 cfs to assure that these persons are not at risk. Warning time from the dam to a distance 34 miles downstream would be equal to or less than 4 hours. Farther downstream, however, an evacuation plan coupled with 4 hours or more of warning time is assumed to result in no additional loss of life. Incorporation of the emergency action plan with the final design should result in an acceptable level of risk, particularly for residences downstream of Birney where warning time would likely exceed 4 hours.

The selection of an SDF and spillway alternative would affect the downstream floodplain. The applicability of the state floodplain regulations, including the 0.5-foot floodway increase, would be investigated by DNRC during the selection of a spillway alternative.

Flood Frequency of SDF Loadings Investigated

Flood frequency analyses have been performed by PRC Engineering (1986) for spring and summer floods for the Tongue River Dam. Using the flood frequency curves, return periods were estimated for each loading and are summarized in **Table E-2**.

TABLE E-2
Return Period Estimates for Tongue River at Dam

Spillway Design Flood Discharge (cfs)	Spring Flood Return Period (yrs)	Summer Flood Return Period (yrs)
60,000	2,000	18,000
100,000	3,300	100,000
150,000	10,000	175,000
191,000	18,000	not estimated
382,000	100,000	not estimated

Source: PRC Engineering 1987.

Historic and Proposed Reservoir Operations

Table E-3 demonstrates the historic reservoir storage contents and elevations. **Table E-4** demonstrates the proposed reservoir storage contents and elevations with no further development of Wyoming's Yellowstone River Compact Water (existing conditions). **Table E-5** demonstrates the proposed reservoir storage contents and elevations with full development of Wyoming's Compact water.

Historic and Proposed Downstream Flows

Table E-6 demonstrates historic flows and representative river depths for riffles just downstream from the dam. **Table E-7** demonstrates representative flows and river depths for riffles just downstream from the dam during construction. **Tables E-8 and E-9** demonstrate representative flows and river depths for riffles just downstream from the dam following completion of the project with no further development of Wyoming Compact water and for full development of Wyoming water, respectively. A minimum desired winter release of 150 cfs or the maximum reservoir inflow (whichever is less) has been assumed for the proposed scenarios.

Table E-10 demonstrates the historic flows and representative river depths over riffles at the Miles City stream gauge. **Tables E-11 and E-12** demonstrate representative flows and river depths over riffles at Miles City following completion of the project with no further development of Wyoming Compact water and with full development of Wyoming Compact water, respectively.

TABLE E-3

Tongue River Reservoir Historical Reservoir Operations (Period From 1946 to 1989)

HISTORIC RESERVOIR CONTENTS (1000 ACRE-FEET)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	AVG
AVERAGE	21.7	20.8	20.2	20.7	28.8	30.1	36.0	40.7	50.9	48.0	29.1	22.6	29.4
MEDIAN	21.1	22.5	19.5	16.1	40.9	30.0	28.2	40.7	53.2	48.0	36.0	21.9	28.7
80TH	14.2	9.5	9.1	9.5	9.7	16.0	17.3	26.0	40.9	35.4	24.3	15.0	18.7
60TH	19.5	15.7	13.6	14.2	16.5	24.3	24.1	36.0	48.2	37.8	28.8	20.8	25.0
40TH	26.0	25.5	26.7	27.4	28.8	30.0	36.0	42.2	58.5	44.4	31.7	20.3	33.8
20TH	30.4	32.8	20.8	33.7	36.0	43.4	43.0	55.8	61.7	50.1	35.2	30.9	40.3
MAXIMUM	33.8	39.0	40.4	41.1	48.6	57.3	59.5	40.9	67.7	58.5	48.0	41.8	50.3
MINIMUM	0.9	4.1	4.1	2.1	7.9	7.9	7.7	40.9	27.5	16.0	5.8	0.8	8.4
HISTORIC RESERVOIR ELEVATIONS (FEET)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	AVG
AVERAGE	3,403.1	3,402.4	3,401.4	3,402.3	3,404.2	3,409.0	3,409.0	3,414.7	3,414.8	3,415.3	3,408.3	3,403.7	3,407.7
MEDIAN	3,402.6	3,403.6	3,401.4	3,398.3	3,400.9	3,408.9	3,407.7	3,414.7	3,419.8	3,415.3	3,408.9	3,403.2	3,407.1
80TH	3,396.2	3,381.8	3,390.6	3,391.1	3,391.3	3,398.2	3,399.6	3,406.2	3,414.8	3,411.8	3,402.7	3,397.1	3,399.2
60TH	3,401.4	3,397.8	3,395.5	3,396.2	3,398.7	3,405.0	3,404.9	3,412.2	3,418.0	3,413.2	3,408.9	3,402.3	3,404.4
40TH	3,406.2	3,405.9	3,406.7	3,407.2	3,408.3	3,412.1	3,412.2	3,415.4	3,424.8	3,416.3	3,410.0	3,405.8	3,410.6
20TH	3,409.1	3,410.6	3,408.7	3,411.0	3,412.7	3,415.8	3,415.7	3,420.7	3,422.7	3,418.8	3,411.8	3,409.5	3,413.9
MAXIMUM	3,411.1	3,413.8	3,414.5	3,414.9	3,418.0	3,421.2	3,422.0	3,424.8	3,424.7	3,421.6	3,417.7	3,419.8	3,418.3
MINIMUM	3,370.7	3,381.8	3,381.8	3,376.5	3,381.6	3,388.9	3,388.5	3,381.6	3,407.2	3,388.9	3,384.9	3,370.1	3,386.0

Source: Department of Natural Resources and Conservation 1994.

TABLE E-4
Tongue River Reservoir Proposed Operations

RESERVOIR CONTENTS (1000 ACRE-FEET) *No Further Wyoming Development - 150 cfs Winter Release*												
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	AVG
AVERAGE	52.8	56.5	58.4	59.9	61.8	66.0	69.8	74.5	77.6	72.8	59.8	54.9	63.7
MEDIAN	55.7	61.9	64.1	66.2	71.1	77.6	80.3	80.3	80.3	77.5	63.6	60.3	68.6
80TH	38.5	40.4	43.1	43.8	45.0	47.5	52.7	69.3	80.3	69.9	54.0	45.6	54.5
60TH	53.5	57.6	62.4	63.9	64.9	69.4	77.8	80.3	80.3	73.3	62.2	56.1	66.6
40TH	60.0	64.2	65.5	69.2	73.4	80.3	80.3	80.3	80.3	80.3	66.6	61.7	70.3
20TH	67.3	72.9	75.1	78.6	80.3	80.3	80.3	80.3	80.3	80.3	68.3	66.7	74.8
MAXIMUM	80.3	80.3	80.3	80.3	80.3	80.3	80.3	80.3	80.3	80.3	80.3	80.3	80.3
MINIMUM	1.6	5.5	6.0	6.0	6.0	6.0	3.4	2.2	16.1	1.5	1.5	1.5	7.9
RESERVOIR ELEVATIONS (FEET) *No Further Wyoming Development - 150 cfs Winter Release*													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	AVG
AVERAGE	3,419.7	3,420.9	3,421.6	3,422.1	3,422.7	3,424.1	3,425.3	3,426.7	3,427.6	3,426.2	3,422.1	3,420.4	3,423.4
MEDIAN	3,420.7	3,422.8	3,423.5	3,424.2	3,425.7	3,427.6	3,428.4	3,428.4	3,428.4	3,427.5	3,423.3	3,422.2	3,424.9
80TH	3,413.5	3,414.5	3,415.7	3,416.0	3,416.5	3,417.5	3,419.6	3,425.1	3,428.4	3,425.3	3,420.1	3,416.7	3,420.3
60TH	3,419.9	3,421.3	3,422.9	3,423.4	3,423.8	3,425.2	3,427.6	3,428.4	3,428.4	3,426.3	3,422.9	3,420.8	3,424.3
40TH	3,422.1	3,423.5	3,424.0	3,425.1	3,426.3	3,428.4	3,428.4	3,428.4	3,428.4	3,428.4	3,424.3	3,422.7	3,425.4
20TH	3,424.5	3,426.2	3,426.8	3,427.9	3,428.4	3,428.4	3,428.4	3,428.4	3,428.4	3,428.4	3,424.8	3,424.4	3,426.8
MAXIMUM	3,428.4	3,428.4	3,428.4	3,428.4	3,428.4	3,428.4	3,428.4	3,428.4	3,428.4	3,428.4	3,428.4	3,428.4	3,428.3
MINIMUM	3,374.8	3,384.4	3,385.3	3,385.3	3,385.3	3,385.3	3,380.5	3,376.8	3,398.3	3,374.4	3,374.4	3,374.4	3,388.8

Source: Department of Natural Resources and Conservation 1994.

TABLE E-5
Tongue River Reservoir Proposed Operations

RESERVOIR CONTENTS (1000 ACRE-FEET) *Full Wyoming Development - 150 cfs Winter Release*													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	AVG
AVERAGE	30.5	34.3	35.6	36.1	36.6	37.9	40.8	51.7	65.3	56.2	39.4	33.9	41.5
MEDIAN	34.3	39.8	39.8	39.8	39.8	43.5	44.2	55.2	78.5	66.2	45.6	35.2	46.6
80TH	2.4	4.2	6.9	9.5	11.3	17.8	20.7	25.1	48.1	33.5	15.1	8.0	18.5
60TH	27.1	29.6	32.0	32.0	32.0	31.8	38.7	47.5	71.4	53.8	39.3	34.0	43.0
40TH	40.9	47.2	48.2	48.2	48.6	50.2	49.3	62.5	80.3	70.7	51.0	44.3	50.4
20TH	51.8	57.0	58.8	59.5	59.6	59.5	59.8	80.3	80.3	75.9	57.8	53.4	61.3
MAXIMUM	73.9	80.3	80.3	80.3	80.3	79.9	80.3	80.3	80.3	80.3	69.3	74.7	74.7
MINIMUM	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.4	1.5	1.5
RESERVOIR ELEVATIONS (FEET) *Full Wyoming Development - 150 cfs Winter Release*													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	AVG
AVERAGE	3,409.2	3,411.4	3,412.0	3,412.3	3,412.6	3,413.2	3,414.7	3,419.2	3,423.9	3,420.8	3,414.0	3,411.1	3,415.1
MEDIAN	3,411.4	3,414.2	3,414.2	3,414.2	3,414.2	3,415.9	3,416.2	3,420.5	3,427.8	3,424.2	3,416.7	3,411.8	3,417.1
80TH	3,377.5	3,382.0	3,387.0	3,391.1	3,393.0	3,400.1	3,402.3	3,405.6	3,417.7	3,410.9	3,397.2	3,389.0	3,400.6
60TH	3,407.0	3,408.6	3,410.2	3,410.2	3,410.2	3,410.0	3,413.7	3,417.5	3,425.7	3,420.0	3,414.0	3,411.2	3,415.7
40TH	3,414.8	3,417.4	3,417.8	3,417.8	3,418.0	3,418.6	3,418.2	3,423.0	3,428.4	3,425.5	3,418.9	3,416.2	3,418.7
20TH	3,419.2	3,421.1	3,421.7	3,422.0	3,422.0	3,422.0	3,422.1	3,428.4	3,428.4	3,427.1	3,421.4	3,419.9	3,422.5
MAXIMUM	3,426.5	3,428.4	3,428.4	3,428.4	3,428.4	3,428.2	3,428.4	3,428.4	3,428.4	3,428.4	3,425.1	3,426.7	3,426.7
MINIMUM	3,374.4	3,374.4	3,374.4	3.374.4	3,374.4	3,374.4	3,374.4	3,374.4	3,374.4	3,374.4	3,373.9	3,374.4	3,374.4

Source: Department of Natural Resources and Conservation 1994.

TABLE E-6
Historic Streamflows Below Tongue River Dam (Period From 1946 to 1989)

HISTORIC FLOWS (CFS)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	AVG
AVERAGE	258	205	191	176	169	235	379	143	1438	562	370	306	441
MEDIAN	213	233	189	173	379	208	327	864	1,236	483	178	321	415
80TH	157	148	149	132	143	470	958	470	667	367	271	190	320
60TH	199	205	185	958	169	178	295	719	940	321	335	267	376
40TH	205	258	194	173	169	235	383	169	1,539	551	398	940	482
20TH	371	347	239	219	224	864	583	1,359	2,241	722	451	398	566
MAXIMUM	509	506	369	287	592	676	958	2,714	3,752	2,083	767	687	851
MINIMUM	71	41	62	80	57	23	80	178	235	169	109	178	153
HISTORIC STREAM DEPTHS OVER RIFFLES (FEET)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	AVG
AVERAGE	1.70	1.66	1.47	1.48	1.48	1.60	2.04	3.10	3.10	2.45	2.02	1.25	2.19
MEDIAN	1.66	1.63	1.49	1.48	1.48	1.66	1.48	2.98	3.50	2.29	2.98	1.66	2.13
80TH	1.37	1.34	1.34	1.27	1.48	1.25	1.48	2.26	2.65	2.02	1.75	1.49	1.89
60TH	1.52	1.54	1.47	1.40	1.48	2.75	1.48	2.75	1.66	2.15	1.93	1.73	2.04
40TH	1.66	1.70	1.50	1.47	1.87	1.66	2.06	1.87	1.66	2.43	2.69	1.66	2.29
20TH	2.03	1.96	1.50	1.58	1.60	1.87	2.50	3.68	4.79	2.75	2.22	2.69	2.46
MAXIMUM	2.35	2.34	2.02	1.79	2.51	2.69	3.13	5.20	5.20	4.63	2.51	2.69	2.96
MINIMUM	0.95	0.73	0.89	1.48	0.86	0.53	1.48	1.51	3.68	1.42	1.66	1.25	1.36

Source: Department of Natural Resources and Conservation 1994.

TABLE E-7
Streamflows During Construction Below Tongue River Dam

MONTHLY FLOWS DURING CONSTRUCTION (CFS)												
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
AVERAGE	242	216	173	173	218	292	383	1,175	1,574	445	201	192
20TH	303	258	216	209	278	374	526	1,649	2,707	622	305	284
50TH	242	216	170	170	199	244	341	1,074	1,475	414	223	174
80TH	190	186	138	124	143	191	262	634	635	224	65	97
MONTHLY STREAM DEPTHS OVER RIFFLES DURING CONSTRUCTION (FEET)												
MEAN	1.66	1.60	1.52	1.52	1.60	1.80	2.04	3.96	4.00	2.20	1.56	1.64
20TH	1.83	1.71	1.60	1.58	1.76	2.01	2.42	4.10	5.28	2.59	1.83	1.77
50TH	1.66	1.60	1.51	1.51	1.55	1.67	1.93	3.30	3.86	2.12	1.61	1.53
80TH	1.63	1.60	1.31	1.23	1.34	1.63	1.72	2.61	2.61	1.62	0.87	1.06

Source: Department of Natural Resources and Conservation 1994.

TABLE E-8
Proposed Streamflows Below Tongue River Dam

MONTHLY STREAMFLOW (CFS) *No Further Wyoming Development - 150 cfs Winter Release*	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	AVG
AVERAGE	268	155	154	153	193	246	424	1449	1551	512	353	269	436
MEDIAN	259	155	150	150	166	150	282	850	1029	424	354	255	436
80TH	268	155	145	120	150	150	166	512	766	337	354	232	328
60TH	259	155	150	150	166	150	227	764	1150	424	354	234	371
40TH	259	155	150	150	166	150	424	1029	1526	428	354	274	426
20TH	259	155	150	150	200	382	444	1449	2188	639	354	308	565
MAXIMUM	392	479	413	330	643	782	662	3223	3546	1646	782	592	854
MINIMUM	268	133	102	89	85	85	163	520	366	317	13	92	209

MONTHLY STREAM DEPTH OVER RIFFLES (FEET) *No Further Wyoming Development - 150 cfs Winter Release*	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	AVG
AVERAGE	1.74	1.41	1.36	1.35	1.50	1.66	1.89	3.23	3.79	2.35	1.98	1.70	2.18
MEDIAN	1.74	1.36	1.34	1.34	1.40	1.34	1.92	2.98	3.79	2.98	1.63	1.70	2.12
80TH	1.70	1.36	1.32	1.22	1.34	1.34	1.50	2.53	1.63	1.93	1.98	1.08	1.91
60TH	1.70	1.36	1.34	1.34	4.10	1.34	1.60	1.98	3.39	2.98	1.63	1.63	2.03
40TH	1.70	1.36	1.34	1.89	3.39	1.38	1.34	3.22	1.63	2.98	1.63	1.08	2.18
20TH	2.08	1.36	1.34	1.89	1.52	2.05	2.20	3.39	4.73	2.90	1.40	1.08	2.46
MAXIMUM	2.08	2.28	2.13	1.92	2.61	2.35	2.65	5.20	5.20	4.10	2.20	2.51	2.97
MINIMUM	1.54	1.27	1.13	1.06	1.38	1.93	1.34	2.37	2.61	1.88	1.98	1.08	1.55

Source: Department of Natural Resources and Conservation 1994.

TABLE E-9
Proposed Stream Flows Below Tongue River Dam

MONTHLY STREAMFLOW (CFS) *Full Wyoming Development - 150 cfs Winter Release*													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	AVG
AVERAGE	267	150	143	128	137	119	202	146	782	377	335	232	279
MEDIAN	259	155	150	146	146	195	195	598	442	337	354	232	267
80TH	259	155	132	107	121	78	150	525	442	337	354	232	295
60TH	259	155	150	135	139	195	195	598	442	337	354	232	295
40TH	259	155	150	150	160	150	119	598	657	385	354	247	295
20TH	285	155	150	150	166	150	213	683	1227	424	354	279	348
MAXIMUM	330	192	301	154	166	150	455	1130	2108	907	379	311	469
MINIMUM	190	143	73	0	0	0	78	285	123	62	24	13	154
MONTHLY STREAM DEPTH OVER RIFFLES (FEET) *Full Wyoming Development - 150 cfs Winter Release*													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	AVG
AVERAGE	1.73	1.36	1.32	1.25	1.29	1.21	1.53	2.60	2.85	2.60	1.93	1.62	1.81
MEDIAN	1.79	1.36	1.34	1.33	1.32	1.48	1.50	2.53	2.20	1.93	1.98	1.62	1.73
80TH	1.79	1.36	1.27	1.36	1.22	1.48	1.48	2.38	2.20	1.93	1.98	1.62	1.81
60TH	1.79	1.36	1.34	1.28	1.29	1.29	1.50	2.53	2.20	1.93	1.98	1.62	1.73
40TH	1.79	1.36	1.34	1.34	1.38	1.48	1.50	2.53	2.64	2.60	1.98	1.67	1.81
20TH	1.79	1.36	1.34	1.34	1.40	1.48	1.56	2.16	3.49	2.16	1.98	1.79	1.97
MAXIMUM	1.92	1.36	1.83	1.36	1.40	1.48	2.23	3.37	4.65	3.05	2.60	1.86	2.26
MINIMUM	1.79	1.31	0.97	0.00	2.60	0.00	1.21	1.79	1.29	0.89	0.55	0.39	1.36

Source: Department of Natural Resources and Conservation 1994.

TABLE E-10
Historic Streamflows at Miles City (Period From 1946 to 1989)

HISTORIC MONTHLY FLOWS (CFS)												
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	AVG
AVERAGE	262	276	206	264	307	580	491	764	1404	480	193	212	448
MEDIAN	241	264	187	187	276	397	480	631	2207	371	167	210	414
80TH	187	150	166	151	566	231	230	268	603	459	102	99	269
60TH	228	214	187	177	214	397	345	554	1059	317	102	193	384
40TH	241	304	207	197	214	485	459	480	1380	439	193	227	467
20TH	346	395	242	234	337	823	724	1176	2176	691	247	247	601
MAXIMUM	694	566	423	501	1795	1782	1692	2982	3825	2207	691	598	986
MINIMUM	10	77	70	78	77	80	12	29	99	13	7	5	57

HISTORIC MONTHLY STREAM DEPTHS OVER RIFFLES (FEET)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	AVG
AVERAGE	1.17	1.17	0.95	0.95	1.27	2.02	1.31	2.44	3.59	1.24	0.96	0.97	1.55
MEDIAN	1.05	1.13	0.93	0.93	1.05	1.54	1.66	2.14	3.40	1.47	0.83	0.96	1.51
80TH	0.74	0.74	0.82	0.79	0.74	1.02	1.02	1.66	0.97	0.81	1.62	0.52	1.15
60TH	1.08	0.98	0.89	0.87	0.97	1.31	1.31	1.96	3.02	1.31	0.97	0.91	1.51
40TH	1.08	1.26	0.95	0.92	1.13	1.78	1.31	2.47	3.59	1.66	0.81	1.62	1.73
20TH	1.39	1.53	1.06	1.99	1.08	2.56	2.35	3.24	4.10	2.28	1.66	1.24	2.07
MAXIMUM	2.28	1.99	1.61	1.82	4.25	4.24	4.10	5.84	6.81	3.24	2.30	2.06	2.89
MINIMUM	0.60	0.52	0.49	0.52	0.60	0.53	0.96	0.24	0.33	0.47	0.00	0.00	0.42

Source: Department of Natural Resources and Conservation 1994.

TABLE E-11
Proposed Streamflows at Miles City

MONTHLY STREAMFLOWS (CFS) *No Further Development of Wyoming - 150 cfs Winter Release*													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	AVG
AVERAGE	229	190	167	184	306	584	412	675	1365	325	75	111	385
MEDIAN	210	180	155	150	207	338	321	543	1247	203	36	28	385
80TH	156	150	133	130	178	229	182	244	597	29	61	32	244
60TH	200	175	154	150	198	312	289	306	1016	159	28	61	302
40TH	228	185	174	166	250	436	400	699	1363	333	61	101	370
20TH	296	212	167	200	332	993	595	1016	1886	502	140	159	525
MAXIMUM	746	556	366	533	1847	1886	1259	3332	3516	1670	382	437	912
MINIMUM	62	97	52	44	50	158	49	125	0	0	0	0	115
MONTHLY STREAM DEPTHS (FEET) *No Further Development of Wyoming - 150 cfs Winter Release*													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	AVG
AVERAGE	0.92	0.60	0.83	0.78	1.27	2.94	1.65	2.24	3.57	1.33	0.54	0.65	1.51
MEDIAN	0.39	0.87	0.92	0.78	0.38	3.38	0.37	1.48	3.38	0.11	0.29	0.54	1.34
80TH	0.83	0.78	0.83	0.72	0.87	0.82	0.26	1.09	2.06	0.11	0.11	0.26	1.06
60TH	0.83	0.60	0.83	0.78	0.93	1.29	1.22	1.48	2.94	0.11	0.82	0.44	1.26
40TH	1.01	0.60	0.85	0.82	1.09	1.65	1.55	2.30	3.57	3.38	0.44	0.00	1.47
20TH	1.24	0.60	0.92	0.34	1.35	2.94	1.65	2.94	3.38	1.33	0.75	0.82	1.34
MAXIMUM	2.40	1.96	0.85	1.90	4.33	1.33	3.38	0.29	0.30	4.05	0.54	1.65	2.74
MINIMUM	0.39	0.60	0.39	0.34	0.38	0.80	0.37	0.29	0.44	0.00	0.02	0.26	0.67

Source: Department of Natural Resources and Conservation 1994.

TABLE E-12
Proposed Streamflows at Miles City

MONTHLY STREAM FLOWS (CFS) *Full Development of Wyoming - 150 cfs Winter Release*													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	AVG
AVERAGE	203	178	156	159	252	455	259	276	598	99	67	84	245
MEDIAN	208	176	154	150	195	312	239	241	444	146	36	57	215
80TH	182	150	132	122	153	211	176	93	131	11	0	0	165
60TH	193	183	145	141	182	288	217	408	276	99	28	42	197
40TH	236	183	172	156	232	346	259	273	560	211	44	74	265
20TH	288	208	182	179	294	663	322	408	1096	358	133	158	314
MAXIMUM	678	269	288	354	1204	1228	822	1237	2077	932	319	360	527
MINIMUM	70	97	59	44	50	158	30	0	0	0	0	0	97

MONTHLY STREAM DEPTHS (FEET) *Full Development of Wyoming - 150 cfs Winter Release*													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	AVG
AVERAGE	1.04	0.89	0.80	0.81	1.09	1.70	1.22	1.17	1.06	0.33	0.47	0.55	1.09
MEDIAN	0.95	0.86	0.79	0.78	0.92	1.29	1.05	1.05	1.67	0.79	0.29	0.98	0.97
80TH	0.79	0.78	0.72	0.69	0.79	0.50	0.86	0.59	0.72	0.04	0.06	0.00	0.82
60TH	0.91	0.89	0.77	0.76	0.88	1.21	0.98	0.59	1.17	0.61	0.22	0.33	0.60
40TH	1.04	0.89	0.85	0.80	1.03	1.06	1.11	1.16	1.97	0.96	0.47	0.50	1.13
20TH	1.21	0.78	0.88	0.87	1.23	2.21	1.58	1.57	3.09	1.43	0.73	0.79	1.29
MAXIMUM	2.25	1.15	1.10	1.42	3.29	3.33	2.56	3.35	1.06	2.78	1.31	1.43	1.89
MINIMUM	0.49	0.36	0.43	0.34	0.38	0.50	0.25	0.00	0.00	0.00	0.00	0.00	0.60

Source: Department of Natural Resources and Conservation 1994.

Dominant Discharge

A common discharge event plays a crucial role in forming and maintaining stream channel characteristics such as channel width, channel depth, and meandering. This flow is known as the dominant discharge. This is defined as the bank-full capacity of the channel and is commonly found to range from the 2-year to the 10-year event.

Existing Condition

Table E-13 presents the average data for selected hydrologic parameters from nine cross-sections covering a 10-mile reach below the dam. Of particular interest is the split of flow between the left overbank, channel, and right overbank. From **Table E-13** it is concluded that the dominant discharge or bank-full capacity below the dam with 10 percent of the flow in the overbanks is about 13,000 cfs or the pre-dam (inflow) 10-year flood.

The 100-year peak outflow from the existing spillway is about 10,000 cfs, less than the dominant discharge. Therefore, since the completion of the dam, the river below has not been subjected to flows equal to or greater than the dominant discharge or bank-full capacity. This condition alone would tend to support a decreasing channel size. However, there are a number of offsetting conditions that have acted to counter this. (Additional evidence would have to be gathered to support and quantify these offsetting conditions.) The offsetting conditions that have tended to stabilize the downstream channel are:

1. Construction of the Tongue River Dam has effectively trapped sediment inflows within the reservoir. However, there is a substantial drainage area and sediment supply downstream of the dam. The reservoir provides sufficient settling time by means of its volume to trap a large percentage of the inflow sediment load.

2. Condition 1 produces discharges from the reservoir that are nearly free of sediment. Moving water has a propensity to carry sediment and sediment-free water searches for sediment to transport. Stated differently, a given flow regime (e.g., depth, velocity) has a given sediment transport capacity that it seeks to satisfy. Therefore, sediment-free discharges from the dam would tend to scour the pre-dam stream channel, resulting in down-cutting and widening of the historic channel. However, this condition has been offset to some extent because the existing spillway has reduced the 10-year flood peak to 43 percent of the pre-dam or inflow flood peak. Therefore, the flow regime has less capacity to transport sediment. In addition, the channel may be intermittently armored to withstand the scour potential of the reduced flood flows. Finally, the duration of flows at 13,000 cfs has been reduced by the combination of the existing spillway and reservoir storage.

The duration of flows under existing conditions is shown in **Table E-14**. The existing project does not discharge flows approaching the dominant discharge until events greater than the 100-year flood. The duration of maximum flows during the 500-year event is reduced from 15 hours for the pre-dam (inflow) condition to 8 hours for the existing spillway condition. These comparisons are shown on **Table E-14**.

From the available data, it appears that the channel immediately downstream from the dam has been altered to a minor degree beyond normal changes since the completion of the dam. In general, all meandering stream channels such as the Tongue River are constantly changing. The response of these stream channels to flood flows, sediment loads, vegetation, and climate is dynamic (constantly changing).

TABLE E-13
Average Flood Data for River Below Dam at Six Flood Flows

FLOW TOTAL	FLOW LOB	FLOW CHANNEL	FLOW ROB	CHANNEL DEPTH	TOP WIDTH	CHANNEL AREA	VELOCITY CHANNEL
9,994	253	9,324	817	10.5	361	2,042	5.6
13,108	428	11,863	817	11.5	416	2,466	6.3
17,646	775	15,338	1,533	14.2	464	3,110	7.0
21,377	1,118	18,031	2,228	14.2	495	3,647	7.3
25,410	1,581	20,835	2,994	15.2	549	4,188	7.8
35,896	2,999	27,692	5,205	17.6	575	5,484	8.6

Source: Morrison-Maierle/CSSA 1994.

TABLE E-14
Duration of Flow at 13,000 cfs for Existing Spillway at Six Flood Recurrence Intervals

RECURRENCE INTERVAL	PRE-DAM DURATION AT 13,000 CFS, hours	EXISTING SPILLWAY DURATION AT 13,000 CFS, hours
5-year	0	0
10-year	1.0	0
25-year	6.5	0
50-year	9.5	0
100-year	11.5	0
500-year	15.0	8.0

Source: Department of Natural Resources and Conservation 1994.

Labyrinth Weir Alternative

The dominant discharge of 13,000 cfs would be equal to the outflow from the 25-year flood under the labyrinth weir alternative. When compared to the existing spillway, this alternative would increase the number of 13,000 cfs events in the downstream channel. Instead of an average of one 13,000 cfs event every 100+ years, there would be an average of four 13,000 cfs events every 100 years. **Table E-15** shows that during the 25-year flood, the duration of flow at 13,000 cfs for the labyrinth weir spillway alternative is 3.5 hours

and the duration for the existing spillway is 0 hours. Under the labyrinth weir alternative, the bed and bank scouring potential could increase noticeably in comparison to the existing spillway in a confined reach of the river below the dam.

TABLE E-15
Duration of Flow at 13,000 cfs for Labyrinth Weir at Six Flood Recurrence Intervals

RECURRENCE INTERVAL	EXISTING SPILLWAY DURATION AT 13,000 CFS, hours	LABYRINTH DURATION AT 13,000 CFS, hours
5-year	0	0
10-year	0	0
25-year	0	3.5
50-year	0	8.0
100-year	0	10.5
500-year	8.0	16.0

Source: Department of Natural Resources and Conservation 1994.

RCC Spillway Alternative

The dominant discharge of 13,000 cfs would represent an event greater than the 100-year flood under the RCC spillway alternative. This alternative would be approximately equal to the existing condition as demonstrated on the hydrographs in **Table E-16**. The RCC spillway alternative reduces the common inflow floods (channel-forming floods) to less than the dominant discharge in a manner similar to the existing spillway.

TABLE E-16
Duration of Flow at 13,000 cfs for RCC Spillway at Six Flood Recurrence Intervals

RECURRENCE INTERVAL	EXISTING SPILLWAY DURATION AT 13,000 CFS, hours	RCC SPILLWAY DURATION AT 13,000 CFS, hours
5-year	0	0
10-year	0	0
25-year	0	0
50-year	0	0
100-year	0	0
500-year	8.0	6.0

Source: Department of Natural Resources and Conservation 1994.

Dam Breach Analyses

Two scenarios were evaluated to determine the extent of the downstream area that would be flooded in the event of a Tongue River Dam breach. The first scenario was the clear-weather breach, or a sudden breach that would occur as the result of an earthquake or a piping failure. The second scenario was that the dam would breach when 4 feet of water was going over the spillway during the routing of the PMF on the Tongue River.

The hydrology/hydraulics study of Tongue River Dam entailed determining a PMP for the area and the resultant PMF[1]. PMPs of 9.9 inches in 6 hours, 15.4 inches in 24 hours, and 19.8 inches in 72 hours were adopted. The combined contribution from snowmelt and baseflow, used with the flood resulting from the PMP, was assumed to be the maximum flood of record during the months when the PMP is most likely to occur (May 1978). The resultant PMF has a calculated peak flow of 382,000 cfs and a 10-day volume of 1,320,000 acre-feet.

The flood hydrographs resulting from the two breach scenarios were routed downstream using the National Weather Service and BOSS DAMBRK models. Both breach floods were routed downstream to a point just below Miles City. The model estimates that the clear-weather breach flood would attenuate to approximately 78,000 cfs at Miles City. The model estimates that the PMF breach flood would discharge more than 369,000 cfs at Miles City. The predicted time of arrival of the flood, however, if more than 24 hours after the breach starts to develop. By then, disaster officials would have had time to make real-time estimates of actual flood characteristics and to update warnings to people likely to be affected by the flood. The flood inundation area for the PMF breach flood is mapped from the dam to Miles City. The flooded areas for both breach scenarios are mapped in the Miles City area.

The clear-weather breach was begun with the reservoir full to the spillway crest. The PMF breach was begun when 4 feet of water started to flow over the spillway, approximately 4 hours after the flood first reached Tongue River Reservoir. Final model efforts used a breach development time of 2.0 hours, breach bottom width of 350 feet, and breach side slopes of 0.5 horizontal to 1.0 vertical. The bottom of the breach was assumed to reach elevation 3,351.4 feet.

The computer model used to estimate the flow, stage, and timing of the dam breach flood provides a mathematical tool to model and approximate real-life characteristics of a flood. The model has been used to recreate the results of real floods from breached dams with some degree of confidence. The results of the model presented herein, however, should be viewed only as an approximation of what actually may occur. Depending on the actual conditions at the time of the flood, more or less area may be flooded, the flood wave may travel faster or slower, and the water depth may vary from that predicted. Therefore, **tables E-17 and E-18** and the inundation maps should be used only as a guideline for where and when to evacuate people in the event that Tongue River Dam should breach. The locations of the cross sections are shown in **Table E-19.**

[1] Developed by Harza Engineering 1983.

TABLE E-17
Tongue River Dam Breach Characteristics

CLEAR WEATHER BREACH (CWB) SCENARIO						
Cross Section (#)	Distance From Dam (miles)	Peak Wave Discharge (cfs)	Travel Time Velocity (fps)	Initial (hrs)	Wave Peak (hrs)	Height (ft)
1	0.0	455,416	9.1	9.1	4.4	56.2
4	3.9	410,210	11.4	0.9	4.7	46.8
9	12.4	326,310	19.9	2.1	3.2	40.5
14	19.9	268,029	7.0	3.5	4.4	24.0
14	21.7	253,706	6.0	0.9	4.7	26.9
15	23.6	236,421	6.8	4.2	5.1	24.1
16	29.1	193,388	6.9	5.4	9.5	29.1
18	33.1	172,831	5.3	6.3	9.5	27.5
24	6.9	153,127	7.9	8.9	9.5	41.4
32	88.9	129,871	8.0	11.8	14.9	21.0
35	62.0	123,166	7.0	19.8	14.9	21.3
46	74.6	105,982	6.8	16.1	16.9	22.5
42	88.9	98,471	9.1	19.8	22.2	25.2
·9	95.6	93,128	9.1	21.2	24.0	24.1
46	106.7	87,406	7.3	23.6	27.3	21.3
51	125.6	80,388	6.4	28.5	32.7	23.2
52	129.5	78,938	6.9	29.6	34.1	28.9
53	130.3	78,819	9.5	29.7	34.2	28.9
54	131.3	78,405	3.5	30.0	34.5	13.9
55	135.3	74,766	5.8	31.5	36.8	14.0
56	137.3	74,269	5.9	32.0	37.4	12.7

Source: Department of Natural Resources and Conservation 1992.

TABLE E-18
Tongue River Dam Breach Characteristics

Probable Maximum Flood (PMF) Scenario						
Cross Section (#)	**Distance From Dam (miles)**	**Peak Discharge (cfs)**	**Wave Velocity (fps)**	**Initial (hrs)**	**Peak (hrs)**	**Wave Height (ft)**
1	0.0	735,863	18.9	4.5	8.8	67.5
4	[illegible].0	644,226	12.5	4.7	8.8	57.0
9	12.4	565,521	12.9	8.0	8.8	51.2
18	18.9	521,834	8.8	9.8	11.0	32.1
14	21.7	504,339	8.3	10.1	11.[illegible]	37.1
15	23.6	486,395	8.8	10.6	11.6	34.6
14	29.1	431,564	8.8	11.4	12.6	40.4
18	33.1	408,982	6.4	12.0	13.5	35.1
24	38.9	376,545	9.2	13.2	15.5	61.0
32	56.6	374,814	9.8	16.6	13.5	40.4
35	62.0	374,440	8.8	17.7	19.5	31.5
39	74.6	373,418	9.2	20.0	22.2	34.3
42	88.9	372,367	8.4	22.8	25.2	40.1
44	88.9	371,531	8.8	24.0	27.0	39.1
14	106.7	370,951	8.8	26.1	29.3	32.9
51	125.6	369,621	7.5	30.5	32.0	36.9
52	129.5	369,402	8.2	31.3	32.9	34.6
53	130.3	369,386	13.8	31.5	33.0	36.9
54	130.3	369,149	4.5	31.8	33.3	23.3
55	135.3	367,681	6.5	33.0	35.3	25.9
56	13[illegible].3	367,424	7.2	33.5	35.9	26.7

Source: Department of Natural Resources and Conservation 1992.

TABLE E-19
Cross Section Locations

NUMBER	LOCATION
54	Tongue River Dam
54	Intermediate Ranch
9	Four Mile Creek
13	4D Ranch
14	McKinney Ranch
16	Brewster Ranch
16	Quarter Circle U Ranch
14	Birney
24	Birney Day School
32	Ashland
35	Stebbins Creek
39	Brandenberg
42	H.S. School
44	Above Garland School
16	Plunket Creek
51	Cowles Creek
52	Calvary Cemetery
53	Interstate 94
54	Pine Hills School
55	Below Sewage Ponds
56	Sunset Memorial Gardens

Source: Department of Natural Resources and Conservation 1994.

Water Rights and Availability

To satisfy the terms of the Northern Cheyenne - State of Montana Water Rights Compact (Compact), the rehabilitation and enlargement of the Tongue River Dam would allow the Northern Cheyenne Tribe to divert up to 20,000 afy from a combination of water stored in the reservoir and exchange water. A second component of the Compact allows the Tribe to divert up to 12,500 afy from the direct flow of the Tongue River. These rights (storage and exchange water from the enlarged reservoir

and direct flows from the river) would be in addition to the existing Tribal water purchase contract for 7,500 afy.

The amount of water that would be available from the enlarged project has been evaluated in a modeling study (Geo Research, Inc. 1991). Six cases of water use proposed by the Northern Cheyenne Tribe are documented in that investigation.

The six cases investigated presented different allocations of Tribal water between agricultural and industrial uses. Four of the cases assume a firm supply of water, and two allow shortages in the agricultural supply. The Compact states that shortages shall not exceed 50 percent of the water compacted to the Tribe in any 1 year, and cumulatively shall not exceed 100 percent of the Tribe's rights in any 10 years. These shortage criteria only apply to the 32,500 acre-feet of compact water; supply of the Tribe's existing 7,500 acre-feet of contract water is firm.

The method of analysis used protects the water supply of existing users by subordinating the Tribe's priority to direct flows after other Miles City Decree users and by operating the reservoir in a manner that prevents it from completely emptying. However, existing users are subject to shortages in 22 percent of the years analyzed because of an insufficient stored water contract amount. Future stored water shortages would be shared proportionately by all water rights holders entitled to Tongue River Reservoir water.

The evaluation allowed for the delivery of the instream flows at the dam and at Miles City that are required by the Yellowstone Water Reservations of 1978. These instream flows are often not available because of their junior priority date. Instream flow availability likely would not change with the proposed project. The overall water supply available in Montana is expected to decrease by over 50 percent if Wyoming appropriates all of its supplemental water and its water allocation under the Yellowstone Compact. Reservoir contents, however, would be significantly higher than in the past because of the increased capacity of the reservoir and the operation of the dam strictly for water supply without the present concern for prevention of spills.

Although the Tribe's combined water rights from reservoir storage and direct flow total 40,000 afy, exchange water and end use of the water (agricultural or industrial) would influence the ultimate supply. Exchange water is that available for diversion by the Tribe from direct flow or from reservoir storage, in exchange for making its return flows available to other users. If the Tribe were to use all of its water for agriculture, it could divert up to 40,000 afy -- assuming that 5,000 afy of return flows would be available to other users as exchange water. If all water was diverted for an industrial use that generated no return flows, there would be no exchange water credit and the Tribe could use a maximum of 35,000 afy.

APPENDIX F

SPECIES LIST

SPECIES LISTS

TABLE F-1
Breeding Status of the Bird Species Observed on the Tongue River Dam Area (Martin et al. 1981)

SPECIES	BREEDING STATUS *	SPECIES	BREEDING STATUS *
Common loon	M	Wilson's phalarope	V
Eared grebe	M	Ring-billed gull	V
Western grebe	t	Franklin's gull	V
Pied-billed grebe	M	Caspian tern	V
White pelican	t	Black tern	V
Double-crested cormorant	B	Mourning dove	b
Great blue heron	B	Black-billed cuckoo	b
Canada goose	B	Screech owl	b
White-fronted goose	M	Great-horned owl	b
Mallard	B	Short-eared owl	t
Gadwall	M	Poor-will	b
Pintail	M	Common nighthawk	b
Green-winged teal	M	White-throated swift	b
Blue-winged teal	M	Belted kingfisher	b
Cinnamon teal	M	Common flicker	b
American widgeon	b	Red-headed woodpecker	b
Northern shoveler	M	Hairy woodpecker	b
Wood duck	t	Eastern kingbird	b
Redhead	M	Western kingbird	b
Ring-necked duck	M	Cassin's kingbird	b
Canvasback	M	Say's phoebe	b
Lesser scaup	M	Least flycatcher	b
Common goldeneye	M	Western wood peewee	b
Bufflehead	M	Horned lark	b
Surf scoter	M	Violet-greet swallow	b

TABLE F-1 (Cont.)

SPECIES	BREEDING STATUS *	SPECIES	BREEDING STATUS *
Ruddy duck	M	Tree swallow	b
Common merganser	M	Bank swallow	b
Turkey vulture	b	Ban swallow	b
Goshawk	b	Cliff swallow	B
Red-tailed hawk	b	Black-billed magpie	b
Swainson's hawk	b	Common crow	t
Rough-legged hawk	B	Pinyon jay	b
Golden eagle	b	Clark's nutcracker	t
Bald eagle	W	Black-capped chickadee	b
Marsh hawk	b	White-breasted nuthatch	b
Osprey	b	Red-breasted nuthatch	b
Prairie falcon	B	House wren	b
Peregrine falcon	b	Rock wren	b
American kestrel	b	Gray catbird	b
Sharp-tailed grouse	b	Brown thrasher	b
Sage grouse	b	Sage thrasher	b
Ring-necked pheasant	M	American robin	b
Turkey	B	Mountain bluebird	b
American coot	b	Townsend's solitaire	b
Yellow warbler	b	Bohemian waxwing	W
Yellow-rumped warbler	M	Cedar waxwing	b
Common yellowthroat	b	Loggerhead shrike	b
Yellow-breasted chat	M	Starling	b
Western meadowlark	b	Solitary vireo	b
Yellow-headed blackbird	b	Warbling vireo	b
Red-winged blackbird	b	Killdeer	b
Northern oriole	B	Spotted sandpiper	b
Brewer-s blackbird	b	Solitary sandpiper	M

TABLE F-1 (Cont.)

SPECIES	BREEDING STATUS *	SPECIES	BREEDING STATUS *
Common grackle	b	Lesser yellowlegs	M
Brown-headed cowbird	b	Semipalmated sandpiper	M
Western tanager	b	American avocet	M
Black-headed grosbeak	b	Vesper sparrow	b
Lazuli bunting	b	Lark sparrow	b
American goldfinch	b	Chipping sparrow	b
Red crossbill	b	Brewer's sparrow	b
Rufous-sided towhee	b	White-crowned sparrow	M
Lark bunting	b	Song sparrow	b

Source: U.S. Fish and Wildlife Service 1992.

* B: confirmed breeding (nest or dependent young observed)
b: suspected breeding (present during breeding season)
V: visitor (breeds nearby, but not on the study area)
t: present but no evidence of breeding
W: winter resident and migrant only
M: migrant only

TABLE F-2
Mammals Observed on the Tongue River Dam Study Area (Martin et al. 1981)

COMMON NAME	SCIENTIFIC NAME
Raccoon	Procyon lotor
Striped skunk	Mephitis mephitis
Coyote	Canis latrans
Red fox	vulpex vulpex
Yellowbelly marmot	Marmota flaviventris
Thirteen-lined ground squirrel	Spermophilus tridecemlineatus
Least chipmunk	Eutemias minimus
Red squirrel	Tamiasciurus hudsonicus
Northern pocket gopher	Thomomys talpides
Beaver	Castor canadensis
Western harvest mouse	Reithrogontomys megalotis
Deer mouse	Peromyscus maniculatus
Northern grasshopper mouse	Onychomys leucogaster
Bushytail woodrat	Neotoma cinerea
Muskrat	Ondatra zibethicus
Porcupine	Erethizon dorsatum
Desert cottontail	Sylvilagus audubonii
Mule deer	Odocoileus hemionus
Whitetail deer	Odocoileus virginianus
Pronghorn antelope	Antilocapra americana

Source: U.S. Fish and Wildlife Service 1992.

TABLE F-3
Amphibians and Reptiles Observed on the Tongue River Dam Area (Martin et al. 1981)

COMMON NAME	SCIENTIFIC NAME
Leopard frog	Rana pipiens
Northern chorus frog	Pseudacris triseriata
Snapping turtle	Chelydra serpentina
Short-horned lizard	Phrynosoma douglassi
Racer	Coluber constrictor
Bull snake	Pituophis melanolencas
Prairie rattlesnake	Crotalus viridus

Source: U.S. Fish and Wildlife Service 1992.

TABLE F-4
Fishes Collected in the Tongue River Reservoir (Elser et al. 1977)

COMMON NAME	SCIENTIFIC NAME
Northern pike	Esox lucius
Carp	Cyprius carpio
Goldfish	Carassius auratus
Golden shiner	Notemigonus crysoleucas
Shorthead redhorse	Moxostoma macrolepidotum
White sucker	Catostomus commersoni
Longnose sucker	Catostomus catostomus
Black bullhead	Iictalurus melas
Yellow bullhead	Ictalurus natalis
Channel catfish	Ictalurus punctatus
Stonecat	Noturus flavus
Largemouth bass	Micropterus salmoides
Smallmount bass	Micropterus dolomieui
Rock bass	Ambloplites rupestris
Green sunfish	Lepomis cyanellus
Black crappie	Pomoxis nigromaculatus
White crappie	Pomoxis annularis
Pumpkinseed	Lepomis gibbosus
Sauger	Stizostedion canadense
Walleye	Stizostedion vitreum
Yellow perch	Perca flavescens
Brown trout	Salmo trutta
Rainbow trout	Salmo gairdneri
Spottail shiner	Notropis hudsonius

Source: U.S. Fish and Wildlife Service 1992.

U.S. DEPARTMENT OF THE INTERIOR
March 3, 1849

DNRC